Prof. Tyndall's Early Experiences as a Civil Engineer.

From the Pall Mall Gazette.

Recently, at the Birbeck Institute, Prof. Tyndall delivered an address based on the experiences of his life. He said: It might prevent some young Birkbeckians from considering their fate especially hard, or from being daunted, because from a very low level they had to climb a very steep hill, when I tell you that, on quitting the Ordnance Survey in 1843, my salary was a little under twenty shillings a week. I have often wondered since at the amount of genuine happiness which a young fellow, of regular habits, not caring for either pipe or mug, may extract even from pay like that. Then came a pause, and after it the mad time of the railway mania, when I was able to turn to account the knowledge I had gained upon the Ordnance Survey. In Staffordshire, Cheshire, Lancashire, Durham, and Yorkshire, more especially in the last, I was in the thick of the fray. It was a time of terrible toil. The day's work in the field usually begun and ended with the day's light, while frequently in the office, and more especially as the awful 30th of November—the latest date at which plans and sections of projected lines could be deposited at the Board of Trade—drew near; there was little difference between day and night, every hour of the twenty-four being absorbed in the work of preparation. Strong men were broken down by the strain and labor of that arduous time. Many pushed through, and are still among us in robust vigor; but some collapsed, while others retiredwith large fortunes, but with intellects so shattered that, instead of taking their places in the front rank of English statesmen, as their abilities entitled them to do, they sought rest for their brains in the quiet lives of country gentlemen.

In my own modest sphere I well remember the refreshment I occasionally derived from five minutes' sleep on a deal table, with "Babbage and Callet's Logarithms" under my head for a pillow. On a certain day, under grave penalties, certain levels had to be finished, and the particular day was one of agony to me. The atmosphere seemed filled with mocking demons, laughing at the vanity of my efforts to get the work done. My levelling staves were snapped, and my theodolite was overthrown by the storm. When things are at their worst a kind of anger often takes the place of fear. It was so in the present instance. I pushed doggedly on, and just at nightfall, when barely able to read the figures on my levelling staff, I planted my last "bench-mark" on a tombstone in Haworth Churchyard. Close at hand was the vicarage of Mr. Bronté, where the genius was nursed which soon afterward burst forth and astonished the world.

It was a time of mad unrest—of downright monomania. In private residences and public halls, in London reception rooms, in hotels and the stables of hotels, among gypsies and costermongers, nothing was spoken of but the state of the share market, the prospects of projected lines, the good fortune of the ostler or potboy who by a lucky stroke of business, had cleared £10,000. High and low, rich and poor, joined in the reckless game. During my professional connection with railways I endured three weeks' misery. It was not defeated ambition; it was not a rejected suit; it was not the hardships endured in either office or field; but it was the possession of certain shares purchased in one of the lines then afloat. The share list of the day proved the winding sheet of my peace of mind. I was haunted by the Stock Exchange. I became at last so savage with myself that I went to my brokers and put away, without gain or loss, the shares as an accursed thing.

When railway work slackened I accepted, in 1847, a post as master in Queenwood College, Hampshire, an establishment which is still conducted with success by a worthy principal. At the time here referred to, I had emerged, from some years of hard labor, the fortunate possessor of two or three hundred pounds. By selling my services in the dearest market during the railway madness, the sum might, without dishonor, have been made a large one; but I respected ties which existed prior to the time when offers became lavish and temptation strong. I did not put my money in a napkin, but cherished the design of spending it in study at a German university. I had heard of German science, while Carlyle's references to German philosophy and literature caused me to regard them as a kind of revelation from the gods. Accordingly, in the autumn of 1848, Frankland and I started for the land of universities, as Germany is often called.

The Mean Temperature of the World.

The Royal Meteorological Society indicates the mean temperature of the months of January and July in London for one hundred years. The lowest mean for January occurred in 1795, and was 25.5° Fahrenheit. The highest mean for January, 47°, in 1876. The lowest mean temperature for July was 55.5° in 1816, and the highest 68°, in 1778 and 1859. The Society also marks in a similar way the mean annual temperatures, and the lowest and highest temperatures for several important and well-known places. The mean annual temperatures in this interesting series of records most worthy of note are for Ferozepore, in the Punjaub, 95°; Calcutta, 81°; Hongkong, 75°; Cairo, 71°; Rome, 60°; Constantinople, 58°; Pekin, 53°; St. Petersburg, 40°; Hammerfest, 35°; Fort Enterprise, 14°; Boothia Felix, which upon this ground should surely be rather marked as "infelix," 5°; and Melville Island, zero. The highest temperatures recorded for the several stations are for Murzouk, in Fezzan. 135°; Bagdad, 120°; Cairo, 116°; Jerusalem, 102°; Greenwich, 97°; Moscow, 90°; Falkland Isles, 75°. The lowest recorded are, for Barbadoes, 72°; Singapore, 66°; Bombay, 53°; Jerusalem, 25°; Constantinople, 17°; Greenwich,—10°; Chicago,—30°; Moscow—53°; Melville Island—65°; Fort Reliance, —70°; and Werschjansk—81°, which outlandishly named, and hard to identify, place, so far seems to possess the unenviable distinction of being the coldest spot upon the earth, unless a station nearer home may be inclined to contest with it the frozen supremacy, upon the ground of an observation that has been made since these comparative records were drawn up. On the evening of the 13th of June last, in the Lecture Theatre of the Royal Institution of Great Britain, in Albemarle Street, a temperature of —252° Fahrenheit, with alcohol turned into a kind of viscid ice, and with oxygen gas congealed into a liquid, was recorded. In this instance, however, it must in meteorological fairness be said the result was brought about by human as well as by natural agency; the spell of boiling solid carbonic acid having been used in the final depression of the temperature. The event is, nevertheless, worthy of a passing mention in this place, as it is probably a record of the greatest cold that has ever yet been brought under the rigid examination of science. *Journal of the Society of Arts.*

USE OF BLAST-FURNACE SLAGS.—At Stuttgart sand made from blast-furnace slag has recently been used largely for laying on the public promenades. It is found very clean, as it does not get muddy in wet weather, nor very dusty in dry weather. It is brought from the works at Wasseralfingen, some fifty miles away, and costs 4½ marks, or 4s. 6d. per cubic metre, at Stuttgart, as against 7 to 9 marks for good river sand.

Good Work by a Locomotive.

From the Utica Herald, Nov. 3.

Engineer Anson C. Fisher, of Utica, and M. Collard, of Albany, have a record to be proud of in their handling of Locomotive No. 567, on the Central Road. It is run by a double crew that alternates every other day in drawing the first Atlantic express east and the accommodation (No. 39) west between Syracuse and Albany —300 miles daily—148 miles each way and four miles in yards getting to and from the trains. Timekeeper Alexander Thompson, of Albany, has forwarded to Engineer Fisher the report of the number of miles run each month within 19 months, 142,008, without a dollar being expended for repairs upon the engine beyond the work that is usual by round house men and engineers. No. 567 came out of the shop March 5, 1883, and continued running until Oct. 15, 1884, when she was taken in again for a general overhauling. Her record is so creditable to Engineer Fisher and Collard that the distance covered each month is given in detail, as follows:

1883.		1884.	
March	6,068	January	6,522
April	7,844	February	7,922
May	8,288	March	8,967
June	7,252	April	8,436
July	7,548	May	9,176
August	8,350	June	8,732
September	1,036	July	6,956
October	4,345	August	7,697
November	7,222	September	8,880
December	8,626	October	5,032
Total	63,619	Total	78,389
Grand total			142,008

Within 19 months Engineers Fisher and Collard have traveled on No. 567 over the Central tracks a distance equal to over 5 3-5 times around the globe without the company being called upon to pay out a cent for repairs. Who can beat this record?

Action of Water on Cement.

According to an article "On the Decomposition of Cement by Water," by H. Le Chatelier, in the *Chemisches Centralblatt*, he has studied the progressive decomposition of cements by water. Hydrated cements when treated with excess of water give up lime; it has hitherto been supposed that the dissolved lime was free lime, and it was determined in this manner; hence the varying results obtained in different laboratories. These amounts are proportioned to the water used, the calcium salts ceasing to be decomposed when the water contains a certain percentage of lime. The free lime, may, however, be determined by solution by using very little water at a time, and only removing it on becoming saturated—1.3 grams CaO per liter. In this manner no calcium compounds will be decomposed, calcium ferrite, the least stable compound of all, only beginning to decompose when the solution contains about 0.62 gram CaO per liter. It was found in this manner that the slowly-hardening cements always contain a large amount of free lime, whereas the quick setting are almost free from it. By the progressive action of water each of the constituents is decomposed in turn, giving a particular amount of lime per liter in the water, which amounts remain constant for each lime compound decomposed. The question cannot be completely answered, as in the solution of the lime there are certain stopping places, corresponding to which there have been as yet no lime compounds prepared synthetically. The author is therefore inclined to the opinion that silico-aluminates and silico-ferrites are formed in hardening, although he has not as yet succeeded in preparing them artificially.

THE Batesville and Brinkley narrow gauge road has been extended from Riverside, Ark., north to Tupelo, 7 miles, making its present length from Brinkley, Ark., north, 40 miles.

"Wood Pavement in the Metropolis."

BY GEORGE HENRY STAYTON, ASSOC. M. INST. C. E.

The necessity for stimulating the efforts of those persons who are actively engaged in the construction and maintenance of street carriageway pavements in the Metropolis and large cities, was strenuously urged during the discussions at the Institution in 1879, when the subject was brought forward by Mr. Deacon[1] and by Mr. Howarth.[2] The object of this Paper is to call attention to the various wood-pavement works recently executed in the Metropolis, and to a comparison of the results obtained thereby. Although the Paper may not contain much that is new, the author ventures to think that the general interest evinced in works which tend to the efficient and economical maintenance of the carriageways of important thoroughfares, and the direct bearing which such works have upon the comfort and convenience of a community, may be sufficient to justify a review of the progress in this system of pavement.

It may not be uninteresting to consider for one moment the extent of the streets of the Metropolis, and the nature of the materials of which the carriageways thereof are formed; and the author desires to tender his warmest acknowledgments to the President, who in his official capacity as the Chief Engineer to the Metropolitan Board of Works furnished him with valuable data, and to Mr. W. Haywood, M. Inst. C. E., the City Engineer, and to forty-three chief surveyors of parishes and districts of the Metropolis, for their courtesy in replying to his communications thereon. The information thus obtained has enabled him to present it in the tabulated form which will be found in Table I. in the Appendix, according to which it appears that at the commencement of the present year, the aggregate length of the streets of London amounted to 1,966 miles. Of that length, however, 248 miles are at present "new" streets, inasmuch as they have not been adopted by a local authority; consequently there are 1,718 miles of public streets under the maintenance of the various authorities, the carriageways of which consist of the following materials, viz.:—

	Miles.
Macadam	573
Granite	280
Wood	53
Asphalt	13½
Flints or gravel	798½
Total	1,718

The extent of the vehicular traffic is equally remarkable, the result of inquiries instituted by the author showing that in the Metropolis alone, at the present time, there are approximately 100,000 horses and 40,000 vehicles, the licensed cabs numbering 10,381, and omnibuses, etc., 2,223, and the estimated value of the horses, harness, and vehicles, amounts to no less than £5,000,000 sterling. Obviously the ordinary wear and tear of these vehicles must in a great measure depend upon the condition of the street carriageways.

No doubt many members of the Institution have a vivid recollection of the extremely unsatisfactory state of those macadamized carriageways in leading West-end thoroughfares, which have given place to wood pavement. It was rarely the case that such roadways were in a good state of repair; on a hot summer day they invariably emitted disagreeable smells and frequently gave off a great amount of dust; and it is scarcely possible to conceive anything more deplorable than the state of such streets whenever the surface became greasy or sloppy after rain. All things considered there was not only undoubted cause for dissatisfaction, but ample justification in the outcry against the former state of things; as what with damage to horses, harness, vehicles, and pedestrians' clothing, together with the sheer waste of money in laying down broken granite to be ground into mud, an alteration was most necessary.

The efficient condition of street carriageways is essentially a ratepayers' question, and the unprecedented adoption of wood as a paving material in substitution of macadam, proves that several of the Metropolitan vestries and other authorities have taken a new departure, and apparently a step in the right direction. In expressing this opinion it will be readily understood that the author in no way desires to pass over the respective merits of granite, asphalt, or bituminous-concrete pavements, and of roadways formed with broken granite, flints, or gravel, as they are undoubtedly suitable for certain localities, and in many cases are economical as compared with wood. While therefore it is asserted that a properly constructed wood pavement possesses the advantages of noiselessness, surface elasticity, safety, and cleanliness, and is pre-eminently suitable and economical for business and residential thoroughfares having a high traffic-standard, it should not be forgotten that in the case of narrow business streets leading out of main thoroughfares, wood pavement might be unsuitable, as by reason of the unimportance of the vehicular traffic, the blocks would probably decay internally long before they were worn out by the traffic. For such reasons, and from a sanitary point of view, it would appear that asphalt would not only be preferable, but also eminently suitable.

Large sums of money were expended during the early years of wood-pavement revival, in the acquisition of patent rights of doubtful value, in experimenting thereon, and in foolish contracts. These stages have been surmounted, and the result is that street paving in the West-end has been almost revolutionized within a few years. Wood pavement has been termed a "West-end luxury," and in one sense the assertion is perhaps justifiable, inasmuch as not more than 4.38 per cent., of the wood pavement in London is east of the City, or south of the Thames.

EXTENT AND CONSTRUCTION.

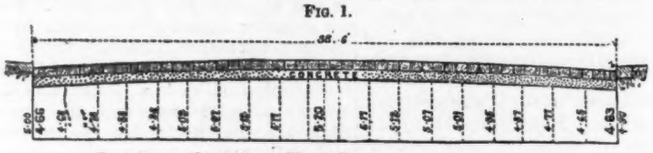
The superficial area of wood pavement laid in London during the last ten years has been 980,533 square yards, its length 53½ miles, and the cost of its construction, together with subsidiary works, has probably involved an outlay of £600,000. On reference to the map (Plate 9) showing the portions paved with wood, it will readily be observed that it is now possible to drive through wood-paved main thoroughfares for a distance of several miles; (*e.g.*) wood pavement is practically continuous from London Bridge, the exception being the eastern part of the Strand, to any of the stations between Chelsea and Uxbridge Road on the West London Railway.

Obviously, much valuable experience and data have thus been gained as to the best mode of construction and maintenance, and as the author ventures to think that a paper on Wood Pavement would be incomplete unless it embraced every detail, however simple he will endeavor to discuss the various points which arise, with a view to ascertaining whether wood has practically realized the expectation, that it would prove to be a safe, convenient, and economical material for street carriageway pavements.

The suitability of "wood as a paving material under heavy traffic" was so fully treated by Mr. Howarth in 1879, that the author thinks it unnecessary to refer in detail to questions which have reference to the proper growth of wood, the cause and effect of wear and tear, and the method adopted for recording the traffic; the object being to describe at length the various points of construction which have hitherto been only partially considered, together with particulars of recent modifications.

Excavation.—The suggestion has been made that macadamized carriageway might be broken up expeditiously with the aid of explosive mixtures, but the author would hesitate to try it; as, however slight the concussion and vibration might be, there is little doubt that gas and water mains and services, especially those which have been in existence for a considerable period, would be injured. Practically there is little variation in the method adopted, the main object being to get the work done as quickly as possible. In preparing for the construction of the wood-pavement works in Chelsea, the method of operation consisted in breaking up the macadamized carriageways by driving steel wedges into and through the consolidated layer of broken granite, commonly called mac, at intervals of a few feet. The surface or crust being thus "started," its removal was effected by prising it upwards in lumps of a square yard or more with stout hand-levers, 6 to 8 feet long, after which it was easily disintegrated. As a rule, a depth of 9 inches of macadam was thus removed, prior to the excavation of some 5 or 6 inches of foundation.

FIG. 1.



TRANSVERSE SECTION OF WOOD PAVEMENT IN SLOANE STREET.
Scale 1/32.

In those instances where the carriageway had previously been paved with granite upon a concrete foundation, as in Oxford Street, it was found unnecessary to disturb the concrete, since by adding about 2 inches thereto, and floating the surface, a satisfactory foundation was obtained, and considerable expenditure avoided.

Levels and contour.—When the width of a street is irregular, and the levels of the footways on either side vary considerably, it is sometimes not a little complex to satisfactorily determined the question of level and contour; but when the longitudinal inclination is naturally slight and uniform, the width parallel, and the footways nearly correspond in level, as in Sloane Street, a very simple rule may be observed.

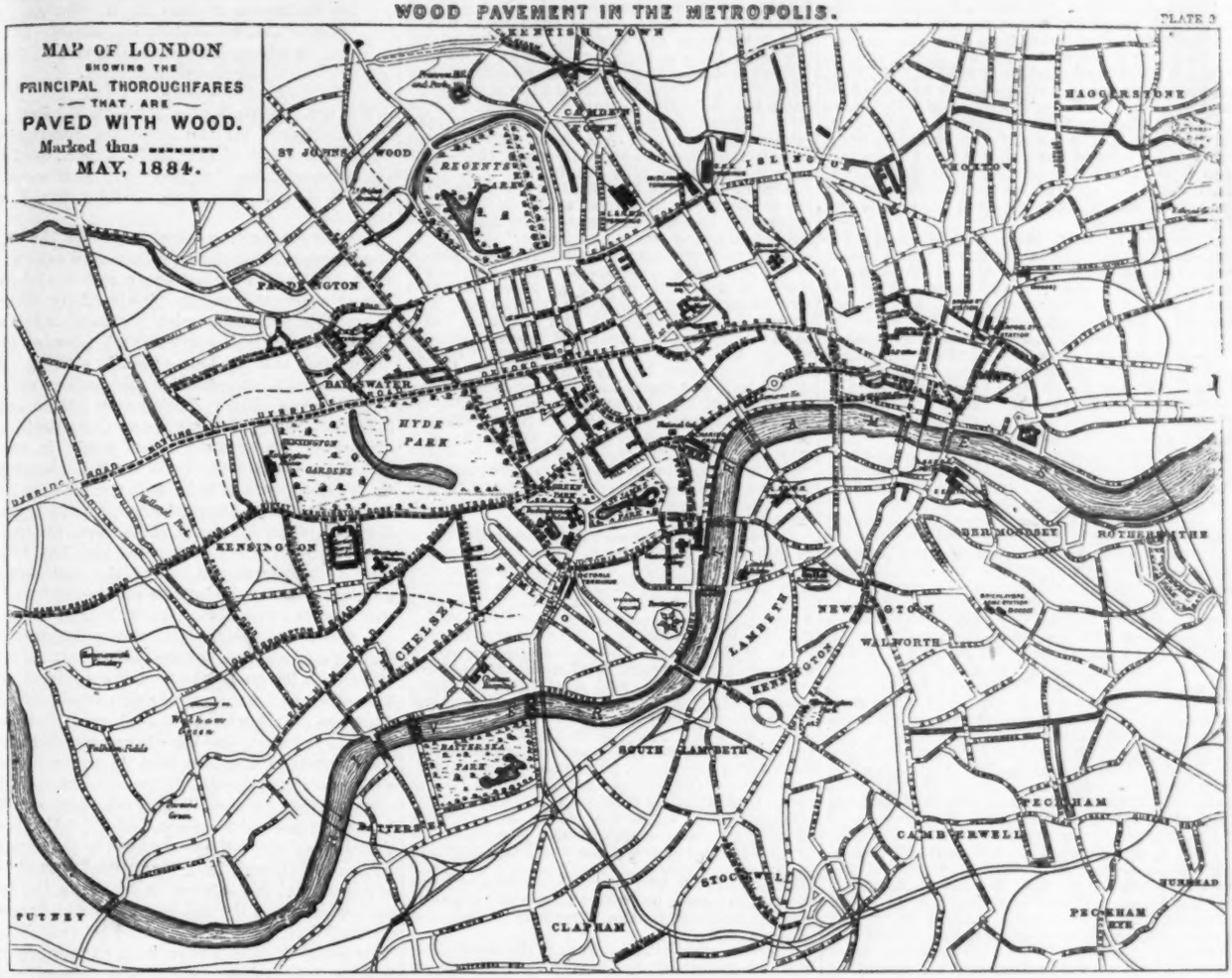
The practice of the author has been to first determine the level of the crown or vertex of the carriageway to be paved, and next to set out the levels of the channels, by allowing a rise to the crown equivalent to 1 inch in 3 feet ($\frac{1}{36}$) above the mean channel level. By slightly flattening the crown, Fig. 1, it will be observed that a contour is obtained which not only renders traffic easy, but is of pleasing appearance, and satisfactory in other points.

Whenever practicable, the longitudinal inclinations of the channels should not exceed 1 in 150, and it is desirable that the minimum depth of kerb exposed at the summit of a channel should be 2½ inches, with a maximum depth of 6½ inches at a gully. By the observance of this rule it necessarily follows, that in a tolerably level street the provision of street gulleys becomes an important item, but the extra cost, about 4 per cent., which their construction entails, is amply repaid not only by the convenient and uniform appearance of the carriage way, but in the prompt and effectual removal of rain-water from the surface of the pavement. The author submits that this is a

[1] Minutes of Proceedings Inst. C. E., vol. lviii., p. 1.
[2] *Ibid.*, p. 31.

WOOD PAVEMENT IN THE METROPOLIS.

PLATE 9



element of success in the construction of wood pavement which, unfortunately, is too often overlooked.

The longitudinal crown should be uniformly sustained from street to street whenever practicable, so as to prevent undulations; and it is likewise important that the crown should be extended transversely at all intersections, partly for the sake of appearance, but mainly to obviate the unpleasant effect which is caused by driving over channels. The neglect of this rule is very apparent upon observing the effect of vehicular traffic over the crossings to Rutland Gate and Princes Gate on the south side of the Kensington High Road.

Foundation.—It is satisfactory to note that foundations consisting of single or double planks placed upon a bed of sand have been completely discarded, and that the fallacies of the so-called elastic foundation have given place to a more permanent system. It was only necessary, shortly after a fall of rain, to witness the effect of a vehicle being rapidly driven over a pavement which had been laid on the former system for a period of two or three years, to have ocular demonstration of its utter unworthiness. The series of little fountains of dirty water which spurted up in the wheel tracks from the open joints would soon have dispelled the hopes of the most ardent believer in the theory; and the result not only made it inconvenient for pedestrians, but very soon caused the pavement to go to pieces.

Although lias-lime concrete has been used as a foundation, it may safely be asserted that 90 per cent. of the existing wood pavement is laid upon Portland cement concrete. The latter, properly prepared, is absolutely impervious, and as a solid and sound foundation is essential for a first-class pavement, the author fails to see that a more suitable material can be substituted. From a variety of causes the strength of the concrete actually used appears to have varied from 5 to 7 parts of Thames ballast to 1 part of Portland cement. In the commencement of the Chelsea works the proportion used was 6 to 1; but it was soon found desirable to provide a quicker-setting concrete, to enable the street to be reopened at the earliest possible moment. The exact proportions, as measured out in boxes, subsequently consisted of 33 cubic feet of ballast to 6.4 cubic feet, 5 bushels of cement, or about 5½ to 1.

It is almost superfluous to state that too much care cannot be taken to ensure the use of none but good cement. With this object in view, numerous samples of the cement supplied for the Chelsea works were tested, the average result of 197 tests by Mr. H. Faija, M. Inst. C. E., showing the strength and quality to be:

Weight per imperial striked bushel	115.45	lbs.
Specific gravity	2.78	
Fineness (25 gauge sieve)	4.18	per cent.
" (50 ")	26.91	"
Tensile strength per square inch at 7 days	571	lbs.
" " " 28 "	677	"

The ground having been carefully bottomed up, regulated, punned, and when necessary watered, small ridges of concrete, technically called "screeds," were formed to the required levels and contour. The ballast and cement for the concrete were measured out and mixed upon a platform, and twice turned over dry, water being subsequently added by means of a small hose attached to a standpipe. Just sufficient water was used to obtain a fair consistency, and as soon as the materials were well incorporated, the concrete was either wheeled or thrown into place, to a minimum depth of 6 inches. To obtain a perfectly smooth and uniform surface, the concrete was floated and "ruled" transversely to the required contour by means of a curved rule, and in four or five days it became sufficiently hard and ready to receive the wood blocks.

That an exeellent foundation was obtained has been frequently ascertained by means of the numerous gas and water trenches which have been made. To break through the concrete necessitates considerable force, and the use of sledge hammers and steel wedges; and specimens prove that it is perfectly sound and good. The entire cost *in situ* averaged 2*s.* 3½*d.* per square yard, an amount which compares favorably with other concretes; and if time were not so important an element in street closing, it might have been executed at a cheaper rate by decreasing the proportion of cement. The cost per square yard is made up of the following items, viz.:—

	s.	*d.*
0.166 cubic yard Thames ballast, at 3*s.* 4*d.*	0	6½
0.74 bushel Portland cement, including extra for facing, at 1*s.* 11*d.*	1.	5
Labor in measuring, mixing, wheeling, laying, and ruling	0	4
Total per square yard	2	3½

In the concrete foundation for Fulham Road a considerable quantity of the old broken granite was screened and mixed with Thames ballast, with a view to practically testing the assertion that an equally serviceable but cheaper concrete could thus be obtained. A similar system has been somewhat largely adopted in other Metropolitan districts, and notwithstanding that a saving of about 3*d.* per square yard was effected in the Fulham Road pavement, the author is not encouraged to view the practice favorably, and does not pro-

pose to revert to it in future works. He ventures to assert that not only is the old granite of greater value for street repairs in less important thoroughfares, but that consequent upon its dirty condition, the efficacy of the cement is somewhat impaired; that the concrete so formed is not so homogeneous as pure ballast concrete, and that it will eventually prove to be less durable than the latter. In support of this view it was recently ascertained by a sample taken up from Fulham Road that such concrete is undoubtedly of inferior quality, and the labor exerted in breaking through it was remarkably small as compared with the former material.

Blocks.—The best form and material for wood-pavement foundation having been ascertained, a question of the utmost importance arises, namely, which of the various kinds of wood available is the most durable and economical? Until this question has been satisfactorily answered it cannot be maintained that the difficulty has been surmounted; in fact, to the absence of reliable information thereon, it is undoubtedly possible to trace the cause of many wood pavements becoming prematurely "worn out" after four or five years' wear. Many theories have been asserted as to the merits of various wood, and a large number of the latter have received a practical test, among them being Baltic and Dantzic fir, pitch pine, spruce, beech, larch, oak, elm, and ash. The shape of the blocks has received no little attention, inasmuch as under various systems they have been cut into rectangular, oblique, hexagonal, octagonal, square, and other forms, and of varying dimensions.

Considerable diversity of practice has also exsited with regard to the condition in which wood has been laid, some blocks having been laid in the natural state of the wood, while others have either been "dipped" in creosote oil, or "dressed" with pitch, and in a few instances they have been properly creosoted. Within the last six or seven years the greater portion of the wood pavement laid in the Metropolis has consisted of rectangular blocks of Swedish yellow deal, or red deal, or pitch pine, but it cannot be denied that thousands of blocks of an inferior nature have also been laid, after being subjected to the process of "dipping" or "pickling."

Prior to adopting wood pavement in Chelsea, the author inspected nearly the whole of the various systems then laid in London (February 1879), and gave their respective merits every consideration, the outcome thereof being that a plain and substantial system was considered the most desirable. The blocks found most suitable, and of which there is an abundant supply, were those cut from Swedish yellow deals (Gothenburg thirds), and if blocks cut from close and evenly-grained, well seasoned, and thoroughly bright and sound deals of that description were always used, the author thinks that they would not fail to give satisfaction. In the construction of wood pavement, it is of the greatest importance that constant supervision should be exercised with a view to ensuring the rejection of improper blocks or blocks which possess even a suspicion of being sappy, knotty, badly cut, or otherwise unsound, or which have been cut out of dead wood, or wood which has been stacked in dock for too long a period. If this system is faithfully carried out, it is doubtful whether there is at present any better wood in the market, of which sufficient quantities can be promply obtained, and which so satisfactorily stands the wear and tear of traffic, and the changes of atmosphere and climate, then Swedish yellow deal, when laid in its natural state.

The result of heavy traffic upon various kinds of wood unquestionably demonstrates that of hard woods pitch pine takes a high place. The price, however, is considerably in advance of fir, and the irregular sizes of the deals creates much difficulty; but if a satisfactory supply from South America in prime condition could always be relied upon, it would no doubt be largely adopted. A section comprising 756 square yards was laid with pitch-pine blocks in King's Road, four and a half years since, as an experiment, and the ascertained depth of the annual vertical wear of the wood during that period, as will be seen by Table III. in the Appendix, is 0.055 inch only. Experience proves that its abrasive wear is better than yellow deal, and as a rule it dries quicker and cleaner; and although pitch-pine takes the best position as regards vertical wear, its extreme hardness may be considered a drawback. This is especially noticeable in the case of rapid traffic, when the wheels of vehicles have lost the rolling motion and strike the surface with great force. It is then that the smallness of the elasticity attached to pitch-pine blocks becomes apparent, by a jarring, bumping motion, which is far from agreeable.

Dantzic fir is durable, but would probably be attended with inconvenience and waste in converting the balks into ordinary sized paving blocks. Neither elm nor oak blocks would withstand the atmospheric changes to which street surfaces are exposed. Larch would probably take a high position as a street-paving material on account of its hardness and durability, but the available supply is apparently too limited to permit its extensive adoption. There is little doubt that American spruce has been laid in London streets under certain conditions, but such wood cannot be regarded as suitable or durable.

A brief reference has already been made to the preparatory treatment which blocks have received. In many instances they have been subjected to the process of being "dipped" in a mixture of creosote oil and other ingredients, while in a few instances they have been creosoted or mineralized, but at least one-third have been laid in a plain or natural state. The author has little faith in the ordinary "dipping" process as a means of preserving the wood; and upon severing "dipped" blocks which have been laid for two or three years, it will be found that a more external discoloration only exists. Indeed it is difficult to ascertain the nature of the merit which the process is supposed to possess, and there may even be truth in the assertion that it is worse than useless, as unfortunately, unscrupulous persons have taken advantage of it as a means of covering up the shortcomings of defective or inferior blocks.

A great deal has been written as to the value of creosoted blocks, and, by way of experiment, a short section upon this system was also laid in King's Road, the blocks creosoted being selected yellow deal. They were subjected to Bethell's patent process, 7 lbs. of hot creosote oil per cubic foot, equal to 10.66 blocks, being injected; and the ascertained depth of annual wear averages 0.139 inch against 0.055 inch for pitch pine, and 0.144 inch for plain yellow deal. The creosoted blocks when taken up for examination were moist internally, and came up easily, whereas the plain blocks and the pitch-pine blocks required considerable force to remove them. The author has invariably noticed that the creosoted section is less clean than any other, and he certainly doubts the wisdom of a system which is not only 20 per cent. more costly, but to a certain extent closes the fibres of the wood and tends to produce premature internal decay. When the latter sets up, it will very soon be found that the traffic causes the fibres to spread, which is quickly followed by the complete destruction of the wood.

There can be little doubt that the reputation of wood pavement has seriously suffered on account of the use of unsound and inferior wood. This may be traced to several causes, either the acceptance of extremely low tenders from inexperienced persons, want of sound judgment in selecting the deals, carelessness, insufficient supervision, especially when the work is hurriedly done, or downright neglect. The experience of the author is, that even with fairly good supervision it is possible for defective blocks to be laid, and it cannot therefore be surprising that unsound wood is used when carelessness, indifference, or neglect is exhibited. As an instance of the success of close supervision, the short section of wood pavement at the extreme north end of Sloane Street may be mentioned. The ascertained traffic, which consists in a great measure of carriages and cabs, is equal to 371 tons per yard width per day, or upwards of 100,000 tons per annum; and although the wood has been laid for four and a half years, the blocks have only worn ⅛ inch, or 0.083 inch per annum, and the surface is in excellent condition. It cannot, therefore, be too strongly urged that street authorities should not only invariably pay a fair price for work, but should provide ample and competent supervision, if they desire to prevent wood pavement from being brought into disrepute.

There is little variation in the dimensions of the blocks, the general size being 9 inches long, 6 inches deep, and 3 inches wide. The lengths have frequently varied from 8 inches to 11 inches, in several instances the depth has varied from 5 inches to 7 inches, but the width, 3 inches, has almost universally been adhered to, it being apparently the best size for foothold, and most convenient to procure. Upon measuring blocks supplied by timber merchants, it will frequently be found that the depth is a trifle short of the specified dimensions, for instance, a 6 inch block seldom exceeds 5⅞ inch, it being understood to be the custom of the trade to make an allowance for the thickness of the saw-cut. The question has often been raised whether 7 inch blocks on the one hand, or 5-inch on the other, would not be more economical than 6-inch; and although there is very little experience thereon, the subject will be alluded to under the heading of durability.

TO BE CONTINUED.

Air-lock, Discharge Pipe, etc., to Caissons of the Baltimore & Ohio R. R. Bridge, now under Construction across the Susquehanna, at Havre de Grace, Md.

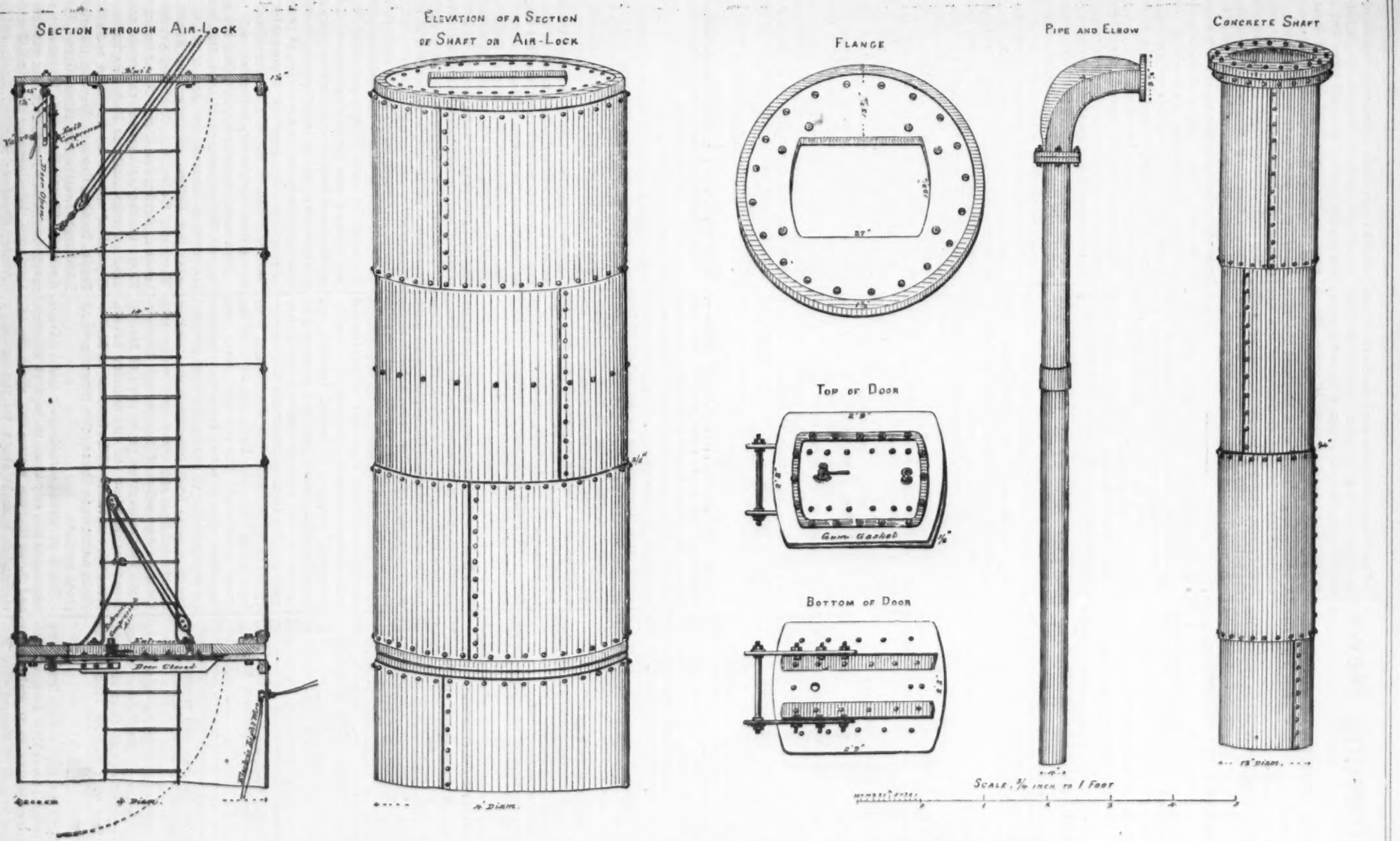
We are indebted to Col. Wm. H. Patton, Eng.-in-charge, for the following description and illustration of the Air-lock, etc., used at the Susquehanna bridge of the Baltimore & Ohio R. R. Co.: Wm. Sooy Smith & Son., Contractors.

The accompanying drawing, shows the discharge pipe for removing material of sand and clay, by the blowing-out process or the pumping process; the supply pipe used for filling the working chamber with concrete, and the elevation, vertical section and plan of the main shaft and air-lock, used in sinking the Pneumatic caissons for the foundations of the Susquehanna River Bridge now under construction by the Baltimore and Ohio Railroad Company. The drawings are made in such detail, that no description is needed. In nearly all previous work of this kind, the air-lock has been a specially designed structure of a larger diameter than the main shaft, and not considered as a part of the same, and has been placed by some at the top of the main shaft and by others at the bottom and sometimes in the working chamber itself. Placed at the top, the inconvenience and delay incident to adding a new section of the main shaft, as the caisson is lowered, has to be submitted to. Placed at the bottom, the dangers incurred are apparent to all who have had experience in this kind of work, and have been attended with fatal results in the past, and in the accident which occurred to one of the caissons on this work, on October 1st, 1884, seven men would, beyond a doubt, have been killed.* Unquestionably, safety to those engaged in this, at all times difficult and dangerous work, should be of paramount importance, but I think, the inconveniences on the one hand and the danger on the other, have been avoided by Gen. Wm. Sooy Smith & Son, whose long experience in this kind of work suggested the remedy for both, and they adopted on this work an air-lock, simple in its construction, easily adapted under all circumstances, and overcoming both the inconveniences and the danger. The main or working shaft is made four (4′) feet in diameter, and in sections of varying lengths, but generally on this work fifteen (15′) feet long. Each section is provided at one end with a thick iron plate or flange, leaving only sufficient space for one man to pass through, which space can be provided with a door, (detailed drawings of which are given) and in this manner each section of shaft can be converted into an air-lock, and if need be, the entire length of main shaft can be utilized as an air-lock, and in adopting this type of air-lock, inconveniences, delay and risk, so far as is possible, are avoided. The question as to the advisability or desirability of lifting your own weight sixty, eighty or one hundred feet vertically in compressed air, or in that of the ordinary atmospheric pressure, is settled by this system in favor of the former, and after all it is a question of secondary importance.

In an air-lock thus constructed a full shift, of from fifteen (15) to twenty (20) men can be admitted at one time.

It will be observed that the elbow at the top of the discharge pipe is so constructed as to resist the abrading action of sand and gravel for a considerable length of time, whereas an elbow of the same thickness of metal as the discharge pipe itself could be destroyed in a day by the same force. This type of air-lock presents a simple, safe and convenient solution of a problem, as to which there has been a considerable difference of opinion and practice and will readily commend itself to all engaged in works of this kind.

* An account of this will be published hereafter in this journal.



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THE New York Central R. R. Co., is building an additional passenger station east of, and adjoining the present Grand Central Depot. It will be 91 feet wide and as long as the present building.

FOR one dollar a traveller can go from New York City to Buffalo; from New York to Chicago the price is as low as $8.00 and it only costs $1.00 more to get to Kansas City, Mo. The Pennsylvania R. R. Co., charge usual rates, $20.00 to Chicago.

THE Japanese Government is about to take an important step in order to extend the commercial relations of Japan with the western world. The announcement is made that, in consideration of an immediate modification of a treaty negotiated with England in 1858, touching the separate jurisdiction of the five treaty ports, Japan is prepared to throw open the entire country, and to remove all restrictions upon foreign residence, travel, and trade.

HENRY F. WALLING, of the U. S. Govt. Geological Survey, has a party in charge of E. W. F. Nutter engaged in the triangulation and topography of the Taconac Range, with head quarters at Lakeville, Conn.

The town of Salisbury, Conn., upon which they are now at work, has elevations ranging from about 500 feet above tide to some 2300 feet above tide. Salisbury has the highest elevation in Connecticut.

THE Transactions and Proceedings of the American Society of Civil Engineers, September, 1884, contains a discussion on the strength of Wrought-Iron Struts and on the strength and elasticity of Structural Steel and its efficiency in the form of Beams and Struts, by Onward Bates, A. P. Boller, E. A. Fuertes, G. H. Pegram, G. Bouscaren, Theo. Cooper, L. L. Buck, Wm. H. Burr, T. C. Clarke, H. R. Towne, E. B. Dorsey, E. P. North, C. C. Schneider, Percival Roberts Jr., Wm. J. McAlpine, O. E. Michaelis, and James P. Christie; also account of some experiments on the Humphrey Turbine Water Wheel at the Tremont and Suffolk Mills, in Lowell, Mass., by James B. Francis. Experiments on the Flow of Water over Submerged Weirs, by James B. Francis.

J. T. FANNING, well known as a hydraulic engineer, has, at the] request of the New Hampshire State Board of Health, prepared an interesting pamphlet upon "Homestead and Suburban Sewerage." This little work is filled with illustrations of the detail of the simpler forms of sewers, in-doors and out, and has many useful tables in this connection. The suggestions and recommendations are sensible and plainly expressed so that the novice may not fail to understand, and the tables referred to include, capacities of pipe sewers, drainage and rainfall data, cost of pipe and amount of trenching, brickwork, etc.

ON Nov. 13, the Alderman of New York again granted the use of Broadway to the Broadway Surface Railway Co., by a vote of 22 to 2. Under the new resolutions the surface road must carry passengers for five cents a head along the newly constructed tracks, and transfer them, without extra charge, from any branch or any connections that may be established with railways already in operation. The directors are required to furnish bob-tail cars from the rolling stock, and are permitted to operate the cars by cable motive power if they want to. For all these privileges they are required to pay annually into the sinking fund for the first five years three per cent. of the gross receipts, and five per cent. every year thereafter. The directors are also to assume the responsibility of paying the same percentage on receipts from passengers that may be transferred from any other road which may become a connection of the new road. Furthermore, they must give a penal bond of $100,000 to pay annually into the city treasury $40,000, being the equivalent of the interest on $1,000,000, in addition to the regular percentages on gross receipts.

This is on terms considerably more advantageous to the city than those first granted, and shows that the matter was worth the investigation brought about by the unseemly haste and suspicious method accompanying the original resolutions.

IN the face of the recommendations of Gen. John Newton, Chief of Engineers, pointing out the urgent need of armored forts and heavy guns, as summarized in our last issue, the present Annual Report, in some of its features, reads like a satire upon the defenceless conditions of our coast-line.

For example, under the heading of the defenses of New York, etc., we notice, as figuring among the chief items of "work done" in the past year, the "pointing-up of a small amount of masonry," the "glazing of window sash," and the "top-dressing with manure of the parade ground." And this with an expenditure of $14,000,000 called for to protect us against the attack of a foreign foe.

While this work may be necessary to preserve from total destruction the interesting relics of a past generation of warriors which now adorn the entrance to America's chief city, we fear it would avail but little as a measure of defense.

Gen. Newton in his report very properly condemns the trust-to-luck policy which seems to actuate the average Congressman when an appropriation is asked for looking towards our better armament. These men, as the General expresses it, expect that should an enemy appear, "they would be turned back somehow, without explaining how, by 'Yankee energy, Yankee skill, or Yankee inventive genius.'"

We advise these gentlemen to back their child-like trust in Yankee energy, skill and inventive talent with the very necessary accompaniments of time and money. If they do this we fear not for the result, but without both we simply remain "as we were," inferior on the high seas to governments as insignificant as Chile, and with our wealthiest towns in a condition inviting attack from any power piratically inclined.

Proposed Plan for a Sewerage System, and the Disposal of the Sewage of the City of Providence, R. I.

The latest and one of the most careful and elaborate reports upon Sewerage and Sewage Disposal is that just sent in to the City of Providence, R. I., by City Engineer, Samuel M. Gray.

Appreciating the value of a personal examination by an acknowledged expert, of the various systems in use in Europe, the City Council of Providence, in February, last, directed Mr. Gray and his assistant Mr. Chas. H. Swan, both members of the Am. Soc. C. E., to proceed to England and the Continent, and to report the result of such investigation with such recommendations with reference to the sewage of Providence as the city engineer might deem expedient.

These gentlemen sailed in the early part of March of this year, and the present report is the result of their labors; the extent of the field covered and the detailed nature of the report speak volumes for their industry and professional ability in digesting a vast amount of material as set out in the variety of practice investigated. The report is accompanied by detailed plans of the city of Providence by wards, float experiments in the Bay, etc.

The systems examined by Mr. Gray included the pail disposal method of Birmingham and Manchester, England; the Liernur, of Amsterdam; the Berlier, of Paris; the Shone, at Wrexham, Wales; the Combined System at London, Berlin, Paris, and Frankfort-on-the Main; the Separate system at Oxford and as tried experimentally at Paris; works for the disposal of sewage by irrigation at Bedford, Berlin, Breslau, Croydon, Dantzic, Doncaster, Edinburgh, Leamington, Milan, Oxford, Paris, Warwick, Wimbledon, and Wrexham; and sewage disposal by chemical precipitation at Aylesbury, Birmingham, Bradford, Burnley, Coventry, Cronberg, Hertford, Leeds, and Leyton, and also to works under construction at Frankford.

As the result of his investigations, at home and abroad, Mr. Gray recommends for Providence, the construction of intercepting sewers, with an outlet at Field's Point, and a chemical treatment for the precipitation of matter in suspension, and the final discharge of the clarified sewage into deep water at Field's Point. He believes that the chemical treatment, while less thorough, will be less expensive, than the irrigation system, on account of the inability to procure sufficient and suitable land at a reasonable cost.

The plan of intercepting sewers, shown in the drawings, includes a lift by pumps to a height of 28 ft. into tanks, with suitable works for the application of the chemicals, and precipitation tanks where it will remain for a short time to deposit the sludge before flowing off into deep water. The sludge, passing into receivers, will be forced by compressed air into filter presses, and there pressed into a portable form; the assumption being that this product will find a ready sale as a fertilizer.

The float experiments convinced Mr. Gray that the crude sewage, if emptied into the Bay at Field's Point, would inevitably create a nuisance to the citizens, to the dwellers on the Providence River and the Bay, and damage, if not destroy, the valuable oyster beds now lining the shores. Of liquid factory waste alone there is now 4,823,000 gallons emptied into the several rivers each week day; this being aside from sewage proper. Mr. Gray points out the fact that this mass must be cared for also, for otherwise no matter how well the city itself is sewered, the waters surrounding the city will still be foul and polluted. The intercepting sewers as designed, will carry this liquid factory waste, but it is for the city authorities to advise whether it be admitted or not.

The estimated daily dry weather flow of town sewage in Providence is now 3,000,000 gallons. As planned, the intercepting sewers will provide for 300,000 inhabitants, and carry off $\frac{1}{50}$ of an inch of rain-fall per hour on the district drained, together with the liquid factory waste referred to and 60 gallons of sewage per inhabitant, including ground water.

The estimated cost of the whole work recommended is $3,699,504, with the pumping plant and precipitation tanks liberally providing for present needs and a complete system of marginal and outfall sewers needed for 300,000 inhabitants.

English experience, in well managed work, shows that the cost of chemicals and labor for treating sewage by precipitation, varies from 24 cents to 36 cents per annum per inhabitant connected with the sewers. While Mr. Gray does not consider this a safe basis for estimate in this country, he is convinced that double these amounts would provide liberally for all our conditions.

In discussing the disposal of sewage by irrigation and otherwise, he says that experience indicates that irrigation will require about one acre of land to one hundred inhabitants; this would necessitate 3,000 acres for 300,000 people. Mr. Gray shows that suitable land at reasonable cost is wanting for this system and to carry the crude sewage to a safe point of discharge in the Bay, as suggested by some parties, would cost $1,194,000 more than by his plan, with an annual cost of pumping nearly double.

The time required for the completion of these works is estimated at 3 years, if pushed with vigor, with part of the system in use at the end of 2 years.

In the form of appendices to the report, and forming its bulkier portion, are descriptions of the various systems of sewerage now in use in England and on the Continent, embracing all the distinctive types. We cannot do justice to the many points of value contained in this portion of the report in a hasty review, but must recommend our readers to the book itself when ready for distribution. But we cannot refrain from saying that we have never yet seen a more satisfactory description and digest of the many and widely different systems of sewage carriage and disposal than is here set forth. An extremely valuable feature, and one too often lacking in municipal publications is that of illustration; the drawings are numerous and exquisitely made and each one is worth pages of ordinary descriptive matter.

The whole report does credit to the city that has had the wisdom and public spirit to authorize its publication, and especially to Mr. Gray, who in so short a time has gathered and presented in a most acceptable shape so large an amount of valuable data upon one of the great questions of the day.

A Winter Bridge over the Mississippi River.

Since the consolidation of the Peoria and Farmington Railway in Illinois and the Central Iowa R. R. in 1883, under the name of the Central Iowa Railway Co., giving the line an eastern terminus at Peoria, Ill., the company have been operating a car transfer at Keithburg, Ill., across the Mississippi River. A transfer boat capable of carrying four freight cars has been used for this purpose This transfer was closed during the winters of 1883-84, and to avoid a similar trouble during the coming winter, the company is now at work upon a winter bridge. The plan consists of an ordinary pile bridge 6 feet above the ordinary winter stage of the river, which will be completed before the river is closed with ice, excepting the steamboat channel which will be completed as soon as ice closes navigation. Surveys have been completed and data secured for the construction of a permanent bridge at this point, which it is the intention of the company to construct during the season of 1885. This bridge will be 2,000 feet long, with 1500 feet of paproaches on each side of the river. Draw span 360 ft., raft channel span 230 ft. and seven spans of 200 ft. The height of piers will be (47) forty-seven feet above the hardpan strata underlying the river bottom at this point. Work is under the charge of John F. Wallace, civil engineer, under whose charge as Chief Engineer and Supt. of construction, the Ill. Division of the Central Iowa Railway was constructed.

Metric Notation.

The variety of abbreviations now in use for the metric system has become so great that confusion is likely to arise and the International Congress has adopted and recommends the use hereafter of the following expressions:

Measures of *Length*:—Kilometre, *Km*; metre, *m*; decimetre, *dm*; centimetre, *cm*: millimetre, *mm*.

Measures of *Surface*:—Square Kilometre, Km^2; square metre, m^2; square decimetre, dm^2; square centimetre, cm^2; square milli metre, mm^2; hectare, *ha*; are, *a*.

Measures of *Volume*:—Cubic Kilometre, km^3; cubic metre, m^3; cubic decimetre, dm^3; cubic centimetre, cm^3; cubic millimetre, mm^3.

Measure of *Capacity*:—Hectoliter, *hl*; liter, *l*; deciliter, *dl*; centiliter, *cl*.

Measures of *Weight*:—Ton of 1000 Kilogrammes, *f*; metric quintal of 100 Kilogrammes, *q*; Kilogrammes, *kg*; gramme, *g*: decigramme, *dg*; centigrame, *cg*; milligramme, *mg*.

These abbreviations should be noted in Italic characters and *not* be followed by a period; and when used they should be put on the same line as the figures and *after the last figure* whether the number effected be a whole number or a decimal.

This unification of notation enables a protest to be entered against the abuse of the comma and period, that finance and commerce use indiscriminately without appearing to understand that in numerical notation the use of the comma is to separate the *fractional* part of the number which precedes it, and that the period is *the sign of multiplication*.

For example, to indicate that 1285 kilogrammes of some material at 3 francs 60 centimes per kilogramme will cost 4626 francs, they write: $1.285 \times 3.60 = 4,626$, which is doubly absurd, for if the multiplication is worked out as indicated by *this* notation, it would be found that the result is not 4 thousand and 626 thousandths, but 231 and 3 tenths.

On the other hand, if for example, we write correctly $2,705.37 = 100,085$, the careless parties to whom we refer would not understand how the number *two thousand seven hundred and five and thirty-seven hundreths* could ever equal *one hundred thousand and eighty five*.

It is true that we teach our pupils to separate numbers into groups of three figures each to facilitate the reading, but this trick ought not to extend beyond the benches of the elementary classes. At the present time the decimal system has replaced almost exclusively ordinary fractions and the × should only be employed in the sense of *by* as when one wishes to indicate the two dimensions of a surface, or a section, or the three dimensions of a solid; as a bar of 105 × 12, etc.

Moniteur Industriel.

PERSONAL.

DANIEL TORRANCE, son-in-law of the late Commodore Vanderbilt, and formerly a Vice-President of the New York Central R. R. Co., died on Wednesday. He was born in Montreal, Canada.

COLUMBUS, Ohio, Nov. 19.—COL. S. H. CHURCH, Superintendent of Transportation of the Pan Handle R. R., and MISS MARGARET, daughter of JOHN JOYCE, were married last night at the residence of the bride's parents in this city. The wedding was a brilliant one, and a prominent social event. A large number of guests were present, many of them from abroad. Gov. Hoadly and staff, of which the groom is a member, were in attendance in uniform.

DAVID BABCOCK, one of the best known contractors of this city, died at his residence, No. 120 East Seventieth-street, on Nov. 12, in the sixty-second year of his age. MR. BABCOCK was a native of this State, and began life by working on the freight boats which passed up and down the Hudson. He was prudent and abstemious and managed to accumulate a little capital, with which he boldly plunged into business as a contractor. His first contract was to furnish the stone for constructing the old tunnel in Brooklyn, beginning at the South Ferry and extending about half a mile, through which the Long Island Railroad passed. This was considered a great work in its day, but it was closed by order of the Brooklyn Common Council some twenty years ago. MR. BABCOCK afterward took the contract for filling in the Battery and furnishing the stone work for the magnificent sea wall which bounds the lower end of Manhattan Island.

MR. BABCOCK constructed a number of the best docks around New York Harbor, and retired from active business about 10 years ago. Two years ago when the New York and Maine Granite Paving Block Company was formed he was induced by his friends to accept the Presidency of the company, but beyond serving in this capacity he had done nothing since his retirement.

A NUMBER of wealthy residents of New Brighton, Staten Island, have applied to the State for a grant of land under water in front of the village. It is intended to form a stock company, and to build heavy cribs outside of the present high-water mark, thus exposing several hundred acres all around the shore fronting on the Upper Bay. This will be filled in and made into a park.

TRACK.*

BY W. B. PARSONS, JR., C. E.
ROADMASTER SUSQUEHANNA DIVISION ERIE R. R.

(*Continued from page 236.*)

Ties sawed only on two sides, face and bottom, are equal to hewn ties in all points except in the first given reason. Ties sawed on four sides have one advantage—uniformity. Split ties never should be received, as the heart is exposed and they rot quickly.

Ties should invariably be stripped of their bark; if not, it will absorb moisture like a sponge and holding it against the wood causes decay. Another reason is that after a time the bark becomes loose, and when the trackmen attempt to tamp, the bark gets under the ties, interferes with the bars and prevents solid work: or else it will work up and show as an unsightly fringe along the edge. Finally, all ties should be cut from young living timber. That which grows on high ground is to be preferred to that growing on low; likewise that which is cut in the winter when the sap is down as being generally more durable. For inspection they should be piled up in square piles in alternate layers, every other layer having but two ties so as to permit free circulation. If the ties are to be stored for some time the top layer should be inclined to shed the rain. The most common varieties of woods used are oak, chestnut, pine, cedar, hemlock, beech, maple, birch and cherry.

Oak.—This is the most desirable of all for both wear and natural durability, its value varying according to the variety, though the exact classification in this direction is often difficult, especially when the bark has been removed. White oak is the best; it can be distinguished by the bark and fineness of grain. It is very hard, resists abrasion by the rail and is slow to rot. Its life even under heavy traffic is about eight years, although it sometimes lasts ten or twelve years. It generally rots out. Rock oak is next in value to white; the bark is rough and not always easily distinguished from some other varieties of rough barked oaks. Yellow oak is a good wood but not the equal of the two preceding kinds; it will cut out, or rot out in from six to seven years. These are the only varieties fit to use. The others are known as black and red, names however that are frequently interchanged according to section of country. They soon decay, their life being but four or five years, and sometimes less.

Chestnut.—This timber ranks next to oak. As regards resistence to decay it is superior to the latter and for that reason always preferred for fence-posts. Under light traffic it can be used as readily as oak, especially on straight lines; its life is indefinite up to ten years according to service, but under heavy running the rail cuts into it and renders it useless in from five to six years. Chestnut ties have a serious tendency to splitting.

Pine.—Both white and yellow are extensively used, with durability in favor of the latter, which is very slow to decay. Its life under light service can be put down as twelve years, but under heavy work the rail has cut into it so far in eight years as to render it unfit for further use. Yellow pine is extensively used in the South and also on the N. Y. Central.

Cedar.—As regards decay this is probably the most lasting wood we have, but it is too soft to withstand pressure of rail and in five years time has to be removed.

Hemlock.—A wood largely used on account of its abundance and low price, a practice far from economical. Lying buried in the ground soon causes rot to set in. It gets soft under rail and around spike holes, and its life cannot be depended upon for over four years, unless the timber is of excellent quality and traffic light. Hemlock is a very treacherous wood, decay starts inside, and a stick outwardly sound is frequently but a mere shell.

Beech.—Of this wood there are two varieties, red and white. The former is quite a durable tie under light traffic, lasting about five years, and is to be preferred over hemlock. The White Beech is quite worthless becoming soft, and cutting out in three years.

Maple, Birch and Cherry.—Woods of not much practical value as they soon go to pieces.

It should ever be borne in mind that there is no economy in buying inferior varieties of timber simply because they are low priced. It takes no more labor to put in a first class oak, than a poor hemlock, tie. The former will last more than twice as long, take less labor to maintain, give better service in the meantime and not require track to be so frequently opened to be re-tied, a proceeding which is always detrimental

TO BE CONTINUED.

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American Society of Civil Engineers.

October 15th, 1884.—Vice-President Joseph P. Davis in the chair. A paper by J. Albert Monroe, on the Re-enforcement of a River Embankment with Condemned Canal Boats, was read. The location was at Kerr's Point, on the Hudson River, on the line of the New York, West Shore and Buffalo Railway, where the shore was a precipitous bluff about 120 feet above the water. A narrow shelf was excavated and the loose rock thrown into the river, where it was held by a somewhat stiff mud. In making the roadbed wide enough for a double track, earth and gravel were used. After standing for some time, a fine crack appeared between the gravel and the rock filling, which gradually increased in width to about 2 inches, when the gravel portion of the embankment slid off and disappeared. There was about 6 feet depth of water where the bank had been, which, with some increase, extended into the river about 75 feet, where it shoaled, owing to the rise of the material displaced by the slide. A number of condemned canal boats were placed with the bows to the shore and as near to the bank as possible. They were placed about 20 feet apart between centres, giving spaces between their sides of about 8 feet. The filling was made carefully into and between the boats at the same time. The sterns being lower than the bows, the material ran gradually to the sterns, and when about half full, the filling suddenly shifted from bow to stern during a high tide. This forced the boats sternwards until they rested against the ridge caused by the previous displacement. They were at about the natural angle of wet sand and gravel slope. The filling was then continued, and the roadway has been permanent. The author considers it particularly important that the filling inside, under and around the boats, should be of substantially the same specific gravity. He instances a case where, under generally similar circumstances, stone filling was, against the advice of an engineer, placed in the bows of the boats, forcing them down, and resulting in their sliding out and being of no use.

A discussion by R. Hering, was read upon the paper by F. P. Stearns, on the Flow of Water through a 48-inch Pipe. The discussion referred to the Kutter formula and its applications. In that paper Mr. Hering gave values of the co-efficient of roughness deduced from experiments, and suggested as the value of that co-efficient for iron pipes, $n = 0.011$. This would give a value for c, in Mr. Stearns' paper, of 141, or substantially the same as obtained from his experiments. Reference was made to the facility of calculations made by means of the diagrams based on the Kutter formula.

A paper by D. FitzGerald, on Spongilla in Main Pipes, was read. The discovery of the *Lacustris spongilla* as the principal source of trouble in the Boston water was made several years since by Professor Remsen. When this *spongilla* is present in the sources of supply, pieces of it find their way into the pipes. These, decaying, give the offensive cucumber or fishy taste to the water. The eggs of the sponge float with the water and attach themselves in large quantities to the interior of the pipes. Soon a soft, light green sponge begins to grow in circular patches. If undisturbed, it gives out long fingers of sponge. Pressure does not prevent this growth. Flushing will not remove it. Some form of wire brush is necessary; perhaps with modifications such as described by E. H. Keating.

November 5th, 1884.—Vice-president. William H. Paine in the chair. The following candidates were elected: As Members—Fred Hixon Baldwin, Tarrytown, N. Y.; Thomas Lafon (elected Junior, March, 3rd, 1875), Retalhuleu, Guatemala: Charles Armstrong Scott, Halifax, Nova Scotia. As Junior—Julius William Schaub, Toronto, Canada.

Amendments to the Constitution and to the By-Laws were proposed.

A paper by Alfred F. Sears, on Commercial Cities, the Law of their Birth and Growth, was read. Reference was made to the fact that there have been many failures in efforts to build up cities upon sites having excellent harbors and superior facilities of access from the ocean. Kalama, on the Columbia River, was projected with large expectations; hotels and churches erected, the railroad built from it to Puget Sound. It, like many other promising sites on the northwestern coast, has been unsuccessful. Comparisons were drawn between Boston and New York, showing that, notwithstanding the fact that forty years ago there seemed to be great promise of a successful commercial rivalry between the cities, if not an absolute commercial superiority for Boston, yet that the result has been entirely favorable for New York, and that the building of railway lines to draw traffic to Boston has not changed the result. The author considers that the advantage of New York is in the fact that the city is more than two hundred miles nearer the heart of the country than Boston. Philadelphia, 120 miles from the ocean, is successful, Baltimore, 180 miles from Hampton Roads, secures commerce. Port Royal, on Hilton Head Island, cannot compete with Charleston or Savannah. Brunswick, Ga. does not rival Savannah. Fernandina, Fla., does not rival Jacksonville. Glasgow at the head of navigation on the Clyde, has had wonderful growth and prosperity. Altoona, on the Elbe, below Hamburg, has been unsuccessful. Astoria, on the Columbia River, a few miles above the bar, has been in existence seventy-five years, but has been surpassed by the much more recent settlement at Portland. Montevideo, on the coast, has a population of forty thousand, while Buenos Ayres, 130 miles up the river, has nearly a half a million. The author considers that the ports on Puget Sound will never be able to become great commercial rivals to Portland, Ore. The law which the author states is, that the commercial port of a region will be as close to the producer as it is possible to go and obtain reasonably good facilities for the class of transportation demanded by the produce of the country. He also considers that trade follows natural channels; that staple products of the soil and all minerals will reach the coast by the route that permits the easiest movement with the least artificial aid, and that the trade of a country will not cross a great valley. It will either create centres of exchange in such valleys, or will follow down their course to a port.

In the record of meeting of September 3rd, an abstract was given of a paper read by Edmund B. Weston, on the Flow of Water through 2½ inch Hose. The formulæ included

in that paper are given below in a more extended form.

Formulæ for flow through 2½ inch hose:

The following formulæ on the flow of water through 2½ inch rubber hose, and smooth and ring nozzles, such as are ordinarily used by fire departments, have been arranged from the general formula presented in the preceding pages, and are intended to be used in connection with all lengths of hose over 40 feet, and for nozzles ranging in size from ¾ of an inch to 1½ inches inclusive. The head in all cases has been considered as that which would be indicated by a pressure gauge attached to a 2½ inch coupling connected with a line of hose, and is equal to what the actual head would be at the same point, less the head due to the velocity in the coupling.

Formulæ for 2½ inch rubber hose with smooth nozzles attached:

$$v = \sqrt{\frac{h}{.0165102 - .000398d^4 + .0000362962d^4l}} \quad (7.)$$

$$G = .0108d^2v \quad (8.)$$

$$h = (.0165102 - .000398d^4 + .0000362962d^4l)v^2 \quad (9.)$$

$$\frac{v^2}{2g} = \frac{h}{1.062 - .0256d^4 + .00233472d^4l} \quad (10.)$$

$$H = .01651v^2 \quad (11.)$$

$$*\ h_J = .01651\,v^2 - \frac{.000000426v^4}{d} \quad (12.)$$

v = velocity of efflux in feet per second.

h = head in feet indicated by pressure gauge, more or less the difference in elevation of the orifice of the nozzle.

d = diameter of nozzle in inches.

l = length of hose in feet from the center of the pressure gauge to the base of the nozzle.

G = gallons discharged per second.

$\frac{v^2}{2g}$ = head in feet due to velocity of efflux.

H = effective head in feet at the nozzle.

h_J = height in feet that a jet will rise above the orifice in still air.

Formulæ for 2½ inch rubber hose with ring nozzles attached:

$$v = \sqrt{\frac{h}{.0166812 - .000221778d^4 + .0000202264d^4l}} \quad (13.)$$

$$G = .030157d^2v \quad (14.)$$

$$h = (.0166812 - .000221778d^4 + .0000202264d^4l)v^2 \quad (15.)$$

$$\frac{v^2}{2g} = \frac{h}{1.073 - .0142658d^4 + .00130104d^4l} \quad (16.)$$

$$H = .01668v^2 \quad (17.)$$

$$*\ h_J = .01668v^2 - \frac{.000000503v^4}{d} \quad (18.)$$

v = velocity of efflux of the contracted vein, in feet per second.

h = head in feet indicated by pressure gauge, more or less the difference in elevation of the orifice of the nozzle.

d = diameter of nozzle in inches.

l = length of hose in feet from the center of the pressure gauge to the base of the nozzle.

G = gallons discharged per second.

$\frac{v^2}{2g}$ = head in feet due to velocity of efflux.

H = effective head in feet at base of nozzle.

h_J = height in feet that a jet will rise above the orifice in still air.

$$v = \frac{G}{(d \times .864)^2 \times .785398 \times .051946}$$

* Box's formula for the height of jets arranged to be used in connection with the above.

A FEATURE of the last issue of Cassel's Magazine of Art is an article on the Cincinnati Art Museum, in which the history of the Museum is given, with several illustrations showing its different stages in building, and a sketch from the architect's drawings, showing how it will look when completed. This is the first of a series on American Art Industries, in which the useful as well as the ornamental arts will be treated.—*Cassell & Company, Limited, New York.*

CORRESPONDENCE.

Question in Drainage.

Special Correspondence Engineering News.

EASTON, PA., NOV. 14, 1884.

EDITOR ENGINEERING NEWS:—Can you inform me if there has been any judicial decision upon any of the points mentioned below:—

A Town is laid out by a company, and a number of buildings erected before it is incorporated by the Legislature. In laying out the streets no attention was paid to the natural contour, and the natural direction of surface drainage is diagonally across many of the sides of the square. Council orders the grading of the streets. Can the drainage continue in the natural course? Will the town be liable for damages, for cutting and filling, by diverting the drainage to the streets? Can the old water course be used for surface drainage or for a sewer without purchasing the right of way?

DRAINAGE.

[We have no present knowledge of any legal decision in a case similar to that cited, though we should imagine the conditions were only too common. Whether the drainage should continue in the old channels, or in new ones provided, is purely a matter of local conditions and engineering expediency. If the authorities deem it to the general interest to remodel the drainage system, they will tax the citizens for so doing, and will be liable for any individual damage arising from the change, future benefit and increased valuation of property being duly considered. As to taking the old drainage channel without compensation for the new sewer, we believe the authorities have no more right to do this than they have to seize upon a small natural water course running through private property. The depression probably existed before the town and served a similar purpose for the carriage of rainfall.

We would be glad to hear from any of our readers who have experience in point.—ED. ENGINEERING NEWS.]

The Institution of Civil Engineers.

SUBJECTS FOR PAPERS.—SESSION 1884-85.

The Council of the Institution of Civil Engineers invite original communications on any of the subjects included in the following list, as well as on other analogous questions. For these, if approved, they will award premiums, arising out of special funds bequeathed for the purpose, the particulars of which are as follows:

1. The Telford Fund, left "in trust, the interest to be expended in annual premiums, under the direction of the Council." This bequest (with accumulation of dividends) produces 250*l.* annually.

2. The Manby Donation, of the value of about 10*l.* a year, given "to form a fund for an annual premium or premium for papers read at the meetings."

3. The Miller Fund, bequeathed by the testator "for the purpose of forming a fund for providing premiums or prizes for the students of the said Institution, upon the principle of the "Telford Fund." This fund (with accumulations of dividends) realizes 160*l.* per annum. Out of this fund the Council have established a scholarship—called "The Miller Scholarship of the Institution of Civil Engineers"—and are prepared to award one such scholarship, not exceeding 40*l.* in value, each year, and tenable for three years.

4. The Howard Bequest, directed by the testator to be applied "for the purpose of presenting periodically a prize or medal to the author of a treatise on any of the uses or properties of iron, or to the inventor of some new and valuable process relating thereto, such author or inventor being a member, graduate, or associate of the said Institution." The annual income amounts to rather more than 16*l.* It has been arranged to award this prize every five years, commencing from 1877. The next award will therefore be made in 1887.

The Council will not make any award unless a communication of adequate merit is received, but will give more than one premium if there are several deserving memoirs on the same subject. In the adjudication of the premiums no distinction will be made between essays received from any one connected with the Institution (except in the cases of the Miller and the Howard bequests, which are limited by the donors), or from any other person, whether a native or a foreigner.

List.

1. Improved Instruments for Surveying and Levelling.

2. Machines and Measuring Apparatus for Testing Metals and the Equipment generally of Mechanical Laboratories.

3. The Mechanical Properties of Cold-Rolled Metal, as compared with Hot-Rolled Metal, and on the Cold-Rolling of Iron Shafting, as practised in America.

4. The Effect produced on Steel by Tempering in Oil and in Water.

5. The Manufacture, Strength, and other properties of Castings of Malleable Cast Iron and Cast Steel.

6. The Thermic Properties of Metals commonly used in the Arts, especially with respect to Conductivity and Diathermancy at high temperatures.

7. The Manufacture of Steel-faced Armor Plates.

8. Ironfoundry Practice as regards Melting, with Results obtained from various Forms of Cupola, Pressures of Blast, etc.

9. The various Systems of Brickmaking by Machinery.

10. Gaseous Fuel, and the Residual Products of Gasmaking.

11. The Manufacture of Artificial Fuel from Small Coal.

12. Steam Boiler Furnaces, with Reference to Fuel Consumption and to the Prevention of Smoke.

13. The Principles to be observed in the Laying-out, Construction, and Equipment of Railways in New Countries.

14. The Theoretical and Practical Effect of Gradients and of Curves on the Speed of Railway Trains.

15. The Application of the Compound Principle to Locomotive Engines.

16. Locomotive Performances, with regard to Weight, Power, Fuel Consumption, and Dynamometer Returns.

17. The comparative Merits of Straight Axles and of Crank Axles for Locomotive Engines.

18. The Design and Construction of Locomotive and Carriage Sheds on Railways.

19. Mechanical Power on Tramways, including Steam, Compressed Air, Electricity, Cables, etc.

20. The Principles involved in the Conservation of Improvement of any Tidal River or Estuary.

21. Descriptions of recent Graving Docks, Gridirons, and Floats.

22. Promenade and other Piers; with reference to the effect of Sea Water on Wrought and Cast-Iron Structures, and the best Means of preserving the same.

23. The Modern Construction of Marine Engines.

24. On Built Crankshafts for Marine Engines, and on the Liability of Crank and Screwshafts to Fracture.

25. Vessels for Inland Navigation, with the Mode of working them by Sternwheels, Screws, etc.

26. The Methods of Removing Rock under Water.

27. Cranes and other Lifting Machinery, employed either in the Construction of Large Works, or for other Purposes.

28. Dredging Machinery for Small Harbors, and for Drainage and Irrigation Canals.

29. The Ventilation of Sewers, with Summary of Experiments as to the Motion, Pressure, etc., of Gas in Sewers.

30. Filter Presses for separating Fluids in Semi-Fluids, particularly for the Treatment of Sewage Sludge.

31 Appliances for the rapid Shipment of Coals, with a comparison of different methods.

32. Winding Machinery, Expansion Gear, and Balancing Apparatus, and the cost per ton of winding under different conditions and varying depths.

33. Underground Haulage, especially on the application of Compressed Air and of Electrical Power

34. The Methods employed in securing large and irregular-shaped Mineral Workings.

35. Gold Quartz Crushing and Amalgamating Appliances.

36. The Manufacture and Desilverization of Lead.

37. Electro-Motors; their theory, practical construction, efficiency, and power.

38. On Gearing for Dynamo Machine Motors, and other high-speed Machines.

39. The Transmission and Distribution of Electricity over large Areas for Lighting and for Motive Power, including Electric Railways, Hoists, etc.

40. Electrical Measuring Instruments.

41. Submarine Telegraph Cables, their manufacture, laying and repair, including deep-sea sounding.

42. Telpherage, or the Automatic Electrical Transport of Goods and Passengers.

43. The Measurement of Works by Dynamometers, with descriptions of the apparatus.

THE Kansas & Gulf Short Line (N. G.) is now in operation from Tyler, Tex., south to Forest, Tex., 70 miles. Of this 24½ miles have already been reported to us as laid from Tyler south, and five miles have been added, bringing it to Jacksonville. From that point south 33½ miles the old Jacksonville & Rusk road is used, leaving 7 miles more laid this year to complete it to Forest.

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E. : M. INST. C. E.

(*Continued from page 227.*)

DCXCV. GONZALES, TEX.,

Gonzales, Texas, in lat., 28° 30′ N., long. 97° W., the county seat of Gonzales Co., is on the Guadaloupe River in a rolling country from which the staple product is cotton.

It was settled prior to 1825, and incorporated a town under the Republic of Texas.

Water-works were built in 1884 by J. M. Walker as a private enterprise, after plans and under the superintendence of T. S. Walker, the supply being taken from the river. The water is conveyed to the pump by a cedar conduit 125 feet in length and 14 inches in diameter, and a Worthington steam pump lifts it 72 feet to two tanks of cypress wood, of 10,000 and 30,000 gallons capacity respectively, and being 51 feet above the city. By direct pumping a fire pressure of 120 to 220 pounds is obtained.

Distribution is by 1½ miles of Kalameined wrought-iron pipe of 4 and 3 inches diameter, with 11 fire hydrants, 4 gates and 60 taps. Galvanized iron is used for services. The city pays $600 yearly for the use of hydrants. The population in 1880 was 1,581, it is now given as 2,000. The works to date have cost $7,000. The entire plan has not been carried out and 3 miles of pipe will soon be laid and the reservoir capacity enlarged. T. S. Walker is Superintendent.

DCXCVI.

Lincoln Park, Chicago, Illinois, is in lat. 41° 52′ N., long. 78° 35′ W.

Water-works were built in 1883 by the city, the supply being taken from Lake Michigan and conducted through 700 feet of 24 inch earthenware pipe to a well, and is thence pumped directly into the mains by a compound duplex Deane pump of 12 inch steam and 10 inch water cylineer and 18 inch stroke, furnishing a pressure of 60 pounds. The distribution is by 4 miles of cast iron pipe of 8 to 4 inches diameter, and is connected with both the Chicago and Lake View systems. The works are managed by the Commissioners of the Park.

No further information can be obtained.

DCXCVII. ADRIAN, MICH.

Adrian, Michigan, in lat. 41° 45′ N., long., 84° 10′ W., is on the South Branch of the River Raisin and is the county seat of Lenawee County.

Settled in 1828 it was incorporated a village in 1836, and a city in 1853. Water-works were built by a private company in 1883–4 taking the supply from ground water. From a well 34.6 feet in diameter and 23 feet deep the water in pumped by a Holly steam pump having a daily capacity of 3,000,000 gallons directly into the mains. Distribution is by 14 miles of cast iron pipe of 18 to 4 inches diameter, with 120 fire hydrants, 100 taps and 10 meters. Kalameined wrought-iron pipe is used for services. The city pays $10,000 annually for the use of hydrants. The daily consumption is 280,000 gallons.

The population in 1880 was 7,849 and is now said to be 11,000. No financial statement is given. S. L. Wiley is President of the Company, and R. H. Baker Superintendent.

DCXVIII. ASHBURNHAM, MASS.

Ashburnham, Worcester Co., Massachusetts, is in lat. 42° 30′ N., long. 72° W.

Water-works were built in 1870 by a private company taking the supply from springs, the water from which is collected in a reservoir formed by a masonry dam built across a ravine, holding about 1,000,000 gallons, and being ¼ a mile distant from and 100 feet above the village. Distribution is by one mile of sheet iron and cement pipe 4 inches in diameter, with 7 fire hydrants and 25 taps. Service pipes are of iron. The daily consumption is 3,000 gallons.

The village does not pay for fire service.

The works have cost $10,000. No further information can be obtained.

The officers of the works are I. W. Adams, W. R. Adams, and G. G. Rockwood.

DCXCIX. ASTORIA, OREGON.

Astoria, Oregon, in lat. 46° N., long. 124° W., is on low ground on the Columbia River, the business portion of the city being built on piles. The country along the river is generally very hilly.

Settled in 1810 it was incorporated a village in 1852 and a city in 1875. Water-works were built in 1870 and 1872 on a small scale, but no information can be obtained in regard to these works. The present works were built in 1883–4 by a private company, taking the supply from Bear Creek, a small stream 12 miles east of the city. The water is impounded in two reservoirs, one holding 100,000 and the other 75,000 gallons, and being about 300 feet above the city. Distribution is by 15 miles of wrought iron pipe of 6 inches diameter. Galvanized iron is used for service pipes. The works went into operation July 1, 1884, and have cost $80,000. The capital stock of the company is $100,000. The population in 1880 was 2,803 and is now given as 6,500. No further information can be obtained. J. W. Welsh is Superintendent.

WATER.

BEAUMONT, TEX., is discussing water-works.

WATER works for Ravenna, Ohio, are contemplated.

RUDOLPH HERING, Sanitary Engineer, of Philadelphia, has submitted a plan of sewerage for Lynn Mass.

AN artesian well at Hurley, only 23 feet deep, spouts a stream of water 4 feet above the surface of the ground.

A DISPATCH from Paris dated Nov. 10, says that the water supply of that city is defective and the water charged with organic matter.

PHILADELPHIA, PA.—Chief Engineer Ludlow will ask Councils to appropriate the funds necessary to provide pumps and other apparatus required to aerate the Schuykill water. The plan will be similar to that used at Hoboken.

THE Ashland Waterworks Company filed articles of association with the Secretary of the State of Wisconsin November 6. The capital stock is $100,000. The company will establish a system of waterworks for the city.

THE Water Committee, of Pittsburgh has awarded the contracts for supplying the Southside with city water. The contract for supplying the pipe was given to A. H. McNeal, of Burlington, N. J., and for laying the pipe, to Booth and Flinn. The contracts are subject to the approval or disapproval of Councils.

THE Ellsworth, Me., Water Works is to be built and operated by a stock company to be composed mostly of substantial business men of Ellsworth and vicinity. A large number have already expressed their intention of subscribing liberally for the stock, and Col. C. C. Burrill, lately elected representative of the State legislature, and who is identified with the enterprise, intends to secure a charter this winter, that they may organize and commence operations in the spring.

The city is greatly in need of better fire-protection as the buildings are mostly of wood and consecutively situated, and the recent disastrous conflagration that destroyed the City Hotel demonstrated the necessity of public water-works.

ON February 10 next the terms of the contract between the city and the Waterworks company, by which the latter engages to complete and maintain a system of fresh water supply expires, and so far the Waterworks company have done nothing in complying with the contract. The bond of the Waterworks company is $25,000 and the penalty for non-fulfillment of their contract is $1,000 per month for every month the work is uncompleted after February 10. The company had a conference recently with the water supply committee of the City Council, probably looking to securing an abrogation of the contract. This committee will probably present the result of the conference to the council at its next meeting.—Galveston, Tex. *News.*

EDITOR ENGINEERING NEWS:—On page 227, Nov. 8th, you publish an item to the effect that the first water company organized in this country was in Baltimore in 1792.

By going back over your files containing "The History etc., of American Water-works" you will find on page 134, Vol. 9: Water-works were built in Bethlehem, Pa., as a private enterprise in 1754. On page 202, Vol. 8, it appears that a company constructed water-works for Providence, R. I., in 1772. On page 152, Vol. 8, it is stated that the Water Company of Baltimore, was formed in 1804 and this I believe to be a correct statement. Between 1790 and 1804 several works were constructed by companies. J. J. R. C.

Respecting the durability of wooden water pipe, a member of the Engineers' Club, of Philadelphia recently said: "The section of spruce was originally about 14 in. in diameter at the large end and somewhat smaller at the other, having a wrought iron band about 1¼ in. wide, ¾ in. thick at one side and tapering to a thin edge at the other, so that it could be driven on or into the end of the log near the outer circumference. A piece of iron pipe 4 in. internal diameter and about 12 in. long, tapering to a thin edge at each end, served to connect the ends of the two adjoining logs, which were driven over it end to end, and prevented from splitting by the iron bands around the ends of the logs. In some cases no interior iron coupling pipe was was used; one log was tapered at one end and driven into the next one, which was prevented from splitting by the exterior iron band. The 4 in. pipes, so found, were of yellow pine, spruce and oak, of about 12 ft. lengths, and from 12 to 24 ft. in diameter, and supposed to have been laid between 1795 and 1805; the depth at which they were found varied from 2 to 8 feet below the surface of the street. The outer bark and heart wood of the spruce logs were generally sound, while the inner bark and sapwood were decayed, except where the soil was dry, gravelly or porous, when the greater part of the wood was decayed and the iron badly corroded. A specimen of red oak from a log adjoining the spruce one was decayed on the under side, but other portions looked nearly as fresh as if recently laid.

PITTSBURGH WATER-WORKS.

Mr. Emile Low, C. E., has kindly sent the subjoined account of the early history of the Pittsburgh, Pa., Water Supply, which is fuller and more detailed than the account given in "The History and Statistics" on page 235, Vol. VIII. ENGINEERING NEWS, June 11, 1881.

J. J. R. C.

The project of supplying the city of Pittsburgh with water, was first broached in the year 1826. On the 24th of February of that year an ordinance providing for a loan to construct water-works was introduced in the borough councils. A committee of the councils called the Water Committee, was charged with the supervision of the work. The Pittsburgh and the Exchange Banks advanced the necessary funds.

A lot of ground on which the engine house was erected, situated at the corner of Duquesne Way and Cecil Alley, was purchased for $1,425.

The reservoir was located on Grant Street opposite the site of the court house which was burned down about two years or more ago. The lot on which the reservoir was built was 240 feet square, and was obtained for the sum of $3,800. The first annual report was submitted by the committee on January 9, 1827, according to which the citizens had declared by nearly an unanimous vote to build water-works.

The revenue from the works in the year 1829 amounted to $3,086. For the first three years the consumption of water was not over 4,000 gallons per day or at the rate of 1,460,000 gallons annually.

On account of the rapid growth of the city, the works now proved unable to supply the ever increasing demand, and about the year 1842 the construction of new works on a more extensive scale was decided upon. Mr. R. Moor, was placed in charge and superintended both the building of the engines and reservoir. The site selected for the engine house was at the foot of what is now Eleventh Street, immediately above the old *Aqueduct* crossing the Allegheny River at this point, but long since torn down, and the reservoir was located on the hill just back of the Union Station, P. R. R. and below the present High School.

The works were completed July 4, 1844, being put into operation on that day.

The capacity of the two engines was together 9,000,000 gallons per day, an amount six times greater than the consumption at that date, which did not exceed 1,000,000 gallons per diem.

SIOUX FALLS WATER-WORKS.

SIOUX FALLS, DAKOTA, November 18, 1884.

EDITOR ENGINEERING NEWS:—I have the pleasure to report the completion of this water-works after only ninety days work in construction.

We have five miles of cast iron pipe of 12" 10" 8" 6" and 4" sizes made by Cincinnati & Newport Iron & Pipe Co., and have now forty-three Ludlow fire hydrants.

Our pumps, two of them, each have a capacity of one million gallons daily and the one that does all the ordinary pumping is run by *waterpower* from the Big Sioux River while the auxiliary pumps is a compound steam pump to use only in emergency. Both pumps are

Worthington make and the pump house and boiler room are granite.

Our water supply is pumped from a large well above town, the well is thirty feet in diameter and is supplied by a large living spring: from this well the water is pumped into a large tank or stand pipe that holds one hundred thousand gallons of water and is one hundred and ten feet above the business streets.

This company operates under a charater and upon a franchise granted to W. S. Kuhn, by which the city agrees for twenty-five years to pay $75 a year for the first 40 hydrants, and $65 a year for each additional one which makes our present revenue $3,195 from city alone; we have also over 40 private consumers secured before we are one month old and have a bright prospect for next spring. The population is 6,000.

The test was successful in every respect being twice the requirement, as the contract was more than fulfilled by us throwing four 1¼ streams at one time full one hundred and thirty feet high and on the next evening the council unanimously approved the contract and accepted the works.

Trusting this information may be acceptable I remain Yours truly,

W. S. KUHN, JR.

[Referring to notices of the failure of the Sioux Falls Water-works, published in this column in the past two weeks, Mr. Kuhn is very indignant and writes us: "The failure was the absence of the Mayor and two Councilmen in Chicago, and also the fact that the fire department did not have four 1¼" nozzles with which to make a test, and the truth also is, that just as quick as the nozzles arrived that we threw four 1¼" streams 130 high at once, when the contract only called for 75 feet high, and an additional truth is, that the Council met the next evening and accepted the works *unanimously*." The item published by us was from the Minneapolis *Tribune*, and we regret that it should have found its way into this column without further confirmation. The foregoing account of the test by Mr. Kuhn cannot fail to prove the falsity of the telegraphed report. ED. ENG. NEWS.]

NEWS OF THE WEEK.

Railroads and Canals.

THE Reading & Chesapeake will be put under contract next February.

THE Pacific & Great Eastern R. has been incorporated in Arkansas to build 317 miles of road.

THE Jackson Branch of the St. Louis Iron Mountain and Southern Railroad has been completed from Allenville, Mo., on the St. Louis Iron Mountain and Southern, northeast to Jackson, 16 miles.

WORK on the Ohio River and Lake Erie road began at Conneautville, Pa., November 1, and and it is expected that it will be finished from Greenville to Erie by spring.

THE Brainerd, Grand Forks and North Western, is the name of the road which is to run from Brainerd, Minn., to Grand Forks and Grafton, Dak. The final survey will not be made until spring.

THE grading on the Dakota & Great South ern from Elliott, Dak., south to a connection with the Chicago, Milwaukee & St. Paul, a distance of 80 miles, will probably be completed before December 1. Voulk Bros. are the contractors.

TRACK has been extended this year on the McMinville branch of the Nashville, Chattanooga and St. Louis from Rock Island, Tenn., north 13 miles to Sparta, and on the Nashville and Tusculoosa branch from Centerville, Tenn., south 13 miles to Aetna Furnace.

THE Florida Southern has received bids for the extension of its road from Leesburg, Fla., to Pemberton's Ferry, on the Withlacochee river, a distance of 30 miles. At the last-named point it will connect with the South Florida road. Contractors are required to give bonds for the completion of the road within five months.

RAILROAD COMMISSIONER BAKER has prepared the following statement of Minnesota railroads for insertion in the descriptive pamphlet of Minnesota for the New Orleans Exposition:

Miles of railway in Minnesota, 4,125.
Average cost per mile, $43,968.66.
Of the seventy-nine counties in the State seventy-four are supplied with railways.
Gross earnings of all the railroads for year, $23,508,089.62.
Operating expenses for year, $13,295,337.45.
Net earnings for year, $10,212,752.17.
Total tonnage, 7,825,704 tons.
Taxes received per year by the State $613,865.64.

ON the Raleigh and Augusta Air Line, track has been extended from Hamlet, N. C., south to Gibson S. C., near the state line, and work is in progress beyond. The road is now in operation from Raleigh, N. C., to Gibson, 107 miles.

THERE is every prospect that the Mandeville and Covington branch of the New Orleans and Northeastern Railroad from Slidell will be built in the near future, as the projectors of the line have secured a very favorable reply to their letter to Mr. John Scott, president and general manager of the Queen and Crescent system.

THE Shade Gap (N. G.) railroad company is building a branch of the East Broad Top Railroad from near Orbisonia, Pa., to the junction with the South Pennsylvania R. R., 15 miles. Track has been laid from Orbisonia to Shade Gap, 5 miles. Mr. E. R. Wood, Philadelphia, is President of the Shade Gap R. R. Co., and A. H. Sims is Chief Engineer.

W. E. SOARE, Chief Engineer of the Port Royal and Detroit River, writes from Port Rowan that there are over forty teams and some 135 Italians at work there. The contract is let to G. Gibson, of New York, and will extend from Dover as far as Houghton Center, 30½ mies. Efforts are being made to complete the work to Big Creek, and to Houghton Center, if possible, by spring.

THE advocates of the Nova Scotia Short Line have addressed a letter to the acting minister of railways, stating that capitalists left New York October 30 to examine the road and country, with a view of undertaking a completion of the work. As this will take time the company desires that 20 days be given them. The time already given the company has expired, but the privy council decided at a cabinet meeting to give them the 20 days asked for, beginning November 1.

THE Anniston and Atlantic is now complete to Sycamore Station, 15 miles south of Talladega, in Talladega county, its entire length being 45 miles. It will in the near future be extended south to Goodwater, Ala., where it will connect with the Georgia Central system. It will also be extended northwest from Anniston about 40 miles to Gadsden and Attala on the line of the Queen and Crescent.

AN exchange says "The Pennsylvania has a corps of engineers at work running a line from Bellaire, O., to Bridgeport, along the edge of the Ohio river. No positive information as to the object can be gathered, but it is believed that they intend to make a short line of some kind between the two places that will cut off the probability of the Baltimore & Ohio extending its tracks to the Cleveland, Lorain, and Wheeling, a preliminary survey for which was made some months ago.

THE Memphis & New Orleans company has applied for a charter in Tennessee to build a road from Memphis to a junction with the Yazoo & Mississippi Valley road in the State of Mississippi at the dividing line between the States of Mississippi and Tenneesee. The new road will form, with the Yazoo & Mississippi Valley and Chicago, St. Louis & New Orleans, a continuous line from Memphis to New Orleans. The incorporators are: James C. Clark, Stuyvesant Fish, James Fentress, Francis Fentress, R. L. Walker, and Luke E. Wright, and evidently represent the Illinois Central Railroad.

RICHMOND, VA., NOV. 14.—Mr. Levenstein to-day introduced a bill in the Senate incorporating the Richmond & Washington City Railroad Company. The bill provides that the incorporators may construct, maintain and operate a line of railroad, with single or double track, from the city of Richmond, Va., to some point on the Potomac River opposite or near the city of Washington, in the District of Columbia, over such route and through such counties, cities and towns as the company may deem expedient to reach the city of Washington.

LOCKPORT, NOV. 19.—The second annual meeting of the stockholders of the Attica, Lockport and Lake Ontario Railroad, the line chartered and surveyed last year to run from Attica to Youngstown on the Niagara River, was held this morning. The following were elected directors: R. S. Stevenson, James Jackson, Jr., E. S. Bowen, W. T. Ransom, J. V. D. Loomis, Jesse Peterson, B. W. Spencer, John Hodge, C. L. Atterbury, S. Park Baker, C. G. Barber, Charles Whitmore and George R. Blanchard. No quorum of the new directors being present, the election of president and other officers was postponed. Robert S. Stevens, of Attica, will undoubtedly be elected president, with John Hodge treasurer, and J. D. V. Loomis, secretary.

THE Rogers, Siloam & Muscogee R. R. Co., capital stock $500,000, has been incorporated in Arkansas.

ON the Cape Fear and Yadkin Valley, track has been extended from Shoe Heel, N. C., southwesterly to Bennettsville, 24 miles, making the road now 159 miles long, from Greensboro to Bennettsville. Extension is still in progress.

LITTLE ROCK, ARK., November 14.—Amended articles of incorporation of the Pine Bluff and Swan Lake Railroad Company were filed today in the office of the Secretary of State. The capital stock is increased $300,000, and the road is to be extended from Swan Lake to St. Charles, Arkansas County.

A WITCHITA telegram to the Chicago *Tribune* says that the extension of the Clearwater Branch of the St. Louis, Fort Scott and Witchita Railroad will begin at once and be pushed with all possible speed to Anthony and the Indian Territory line.

THE Chicago and Surburban Street Railway Company has been organized at Chicago; for the construction of street railways in the city of Chicago and other portions of Cook County; capital stock $500,000. Incorporators—Roscoe W. Gage, Wm. H. Calhoun and H. H. McDuffee.

GENERAL manager Van Horne of the Canadian Pacific is reported as saying that one of the first branches of this system to be constructed will be that from Ingersoll through London and Chatham to the Detroit river, and that he is confident that the work will be begun next spring.

THE President has accepted a section of 25 miles of the Northern Pacific Railroad in Washington Territory, extending southeastwardly from Tacoma to a point near South Prairie, but has directed that no patents for the lands lying along this section shall issue until he gives specific orders to that effect.

THE southern extension of the Florida Railway and Navigation company's Peninsula division has been located to Plant City, the point of junction with the South Florida road. Grading is now in progress and a large part of the rails required have been received. Track-laying will shortly be begun and will be pushed as fast as possible.

THE Williamsport & North Branch, formerly the Muncie Creek Railroad, is intended to run from Hall's Station, Pa., on the Philadelphia & Reading, northeasterly to Bernice, where it is to connect with the State Line & Sullivan Railroad. Track has been laid as far as Glen Mawr, 15½ miles beyond Hall's Station, and 6 miles beyond the previous terminus at Picture Rocks. Grading is in progress.

THE grading on the Americus, Preston and Lumpkin road is now progressing well, over 700 men being employed in grading, clearing the right of way, and bridge building. Grading is nearly all completed from Americus, Ga., on the Central Railroad of Georgia to Preston, and ties are now being delivered along the line. Nearly all the bridges are completed, two only remaining to be finished.

ARTICLES of incorporation of the Minneapolis and Western railway were filed in Minnesota recently. Wm. Pettit, William Cahill, Henry W. Holmes, C. A. Pilsbury, C. W. Moore, Charles J. Martin, Woodbury Fisk, C. H. Pettit, and J. K. Sidle being the incorporators. The capital stock is $50,000, divided in 500 shares. The road is intended to enable a number of Minneapolis millers to provide better trackage facilities at their mills.

GALENA, NOV. 12.—A large party of Railroad surveyors arrived in this city yesterday, and commenced operations in the town of Guilford, this county. The party is now in the employ of the East Shore (Mississippi River) enterprise, which is undoubtedly fostered and encouraged by the Chicago, Burlington, and Quincy Company. The object of the survey as reported is to lay out a line from Forreston, Illinois, via Galena, to the Mississippi River, thence along the east shore of that stream to St. Paul and Minneapolis.

THE directors of the Knox & Lincoln Railroad Company held a meeting at Bath, Me., last Saturday and received the reports of the various officers. They issued the call for the annual meeting to be held at Damariscotta Decemcer 3d. The third article to be acted upon at the meeting is to see what action, if any, the stockholders will take in relation to an extension of the road, to some point nearer the business center of the city of Rockland. Article fourth is to see what acion, if any, the stockholders will take in regard to the building of a new ferry boat.

TRACK on the Pacific division of the Burlington Cedar Rapids and Northern is now laid from Lake Park, Iowa, northwest, via Sibley, Iowa, and Luverne and Pipestone, Minn., about 157 miles, to within about 8 miles of Watertown, and will be completed in a few days to the latter point.

THE surveys of the Northern of Guatemala from Port Barrios to the city Guatemala have been completed, and the company is now negotiating for enough steel rails to lay the entire length of the road, which is about 160 miles. The forces of men which have been sent from New Orleans to Guatemala are now at work cutting timber for cross ties and bridges and clearing a right of way, and it is understood that the work is progressing rapidly, and will be completed as soon as it is possible for the projectors to push it through.

RECENTLY a number of Midland railway, England, officials made a "tour of inspection" of an exceedingly novel miniature railway. The line has been designed and consrructed at the instance of Mr. A. Percival Heywood, as a practical illustration of his own pet notion of a light narrow gauge for military, agricultural, or other purposes. It is situated within Mr. Heywood's picturesque private grounds, and is one of the curiosities of the district The line is laid like a pair of spectacles or the figure 8. It is 15 inch gauge, the maximum gradients being 1 in 25, and the minimum curves half-a-chain radius. The rolling-stock comprises two locomotives, which are models of mechanical ingenuity; a bogie carriage capable of accommodating 16 persons, and a number of open carriages and merchandise wagons.

Miscellaneous.

BIDS will be received by the Department of Public Works of this city, until November 27, for sewer building and street grading in the upper part of the city. See *City Record*.

THE new iron-girder bridge across Bayou des Allemands, on the Morgan's, Louisiana and Texas Railroad, is fast approaching completion, and will soon be in a condition to allow the passage of trains over it.

BIDS will be received by the Department of Public Works of this city until Nov. 26 for sewers in Lexington Avenue, Eighty-third St. One-hundred and Fourth St. and grading on several streets and avenues. See *City Record*.

PANAMA, November 14.—Launches, tugs, dredges, excavators, material and men continue to arrive in quantities and numbers for canal work, which continues with activity. New contracts are daily being given out, and, during the coming dry season, 50,000 men will be employed along forty-seven miles of the work.

OCEAN DEPTHS.—As to the depths reached in sounding the ocean, Lieut. Berryman obtained bottom at 4,580 fathoms a short distance south of the Banks of Newfoundland. The depth of the sea is commonly exaggerated. People used to think that it ranged from 7,000 to 8,000 fathoms. The average depth is 2,500 fathoms in both the Atlantic and the Pacific.

THE Greenpoint & Lorimer Street Railroad Company, Brooklyn, has been incorporated with $120,000 capital. Its route will be from the Greenpoint Ferry to Broadway and First Street, in Greenpoint Avenue, Franklin Street, Meserole, Manhattan and Van Cott Avenues, Lorimer Street and Broadway. Cars will be run from Broadway and Division Avenue to connect with the Lee and Nostrand Avenue line to Prospect Park.

NEGOTIATIONS are reported as being in progress between the directors of the North British Railway and the authorities of Perth, with the view of considerably reducing the height of the new Tay Bridge. In consideration of a sum of £93,000 being paid by the railway company, Perth will withdraw its opposition, and the height of the bridge will be reduced to fifty-three feet instead of eighty feet.

BIDS or Proposals for Constructing the New Croton Aqueduct in the Twenty-fourth Ward of the City of New York, and in Westchester County, will be received until Monday, December 8, 1884, at 12 o'clock M., at which place and hour they will be publicly opened and read by the Aqueduct Commissioners and the award of the contract will be made by said commissioners as soon thereafter as practicable. Bidders can bid for either one or for more of the sections; but each section must be bid for, and will be awarded separately. Any bidder for more than one section who will not accept an award for one section only must so state in his bid. For further particulars see *City Record*.

THE contract for dredging in Wilmington Harbor, Cal., has been awarded to Benson and McNee, of San Francisco.

CAPT. EADS, with members of the Congressional Committee interested in them atter, has gone to Galveston to investigate the deep water problem.

ON November 12. the Washington monument reached a greater height than that of any other structure in the world, being 520 feet 10 inches above the floor of the monument. The next highest structure is the spire of the Cologne Cathedral, which towers 515 feet above the floor of the building.

THE trunk sewer in Buffalo, upon the construction of which the hydraulic tunneling apparatus, recently described in this column, is being employed, has reached the corner of Main & Swan streets where it runs under a reservoir holding 30,000 gallons of water. This is being pumped out so that the sewer may proceed.

THE Emperor of Brazil has recently sent a letter to Captain James B. Eads, requesting him to visit the port of Rio Grande do Sul and give his opinion as to the proper mode of improving that harbor. An able Brazilian engineer,and Mr. Hawkshaw, of Great Britain, have both prepared plans for the works, but that the government is unwilling to proceed without first submitting the question to Capt. Eads.

A CRAZE for flats has sprung up in San Francisco, and as fast as the buildings are finished they are filled with tenants. The demand for apartments in them this fall is very great. There are now several hundred of these houses in the city. They are mostly of two stories, the style of enormously high buildings prevailing in the eastern cities being avoided.

Prof. Austin states that many clay and iron sewer pipes and house leaders are pervious to sewer gases. In one instance in Jersey City the leader was so porous that the parlor was renderd almost uninhabitable. He recommends that all sewer pipes be thoroughly varnished with sheliac or soluble glass, or else painted with heavy paint.

ACCORDING to the *Washington Star*, the Von Schmidt dredge, as used at Oakland, Cal., is to be put to work on the Potomac Flats. The bid of Benson & McNee with that machine is 12.37 cts. as against 19¾ cts. per cub. yd. by Sanford & Ross; and the material is to be measured in place instead of on the scow. The new dredge cuts the material loose by a horizontal cutting wheel, pumps it up a vertical tube and by means of a carrier-tube deposits on the shore or where desired. The transportation is done by water acting with a velocity of 30 feet per second.

THE opening of bids for furnishing Hotchkiss banded-cored shot to the Ordnance Department of the Army took place last Friday. But one bid was received, that of the West Point Foundry Association. The Association agreed to deliver at West Point Foundry, Cold Springs, N. Y., on or before December 31, 1884, the following projectiles:

Five-Hundred 8-inch Hotchkiss banded-cored shot at $13.70 each, the tenacity of the metal to be not less than 25,000 pounds, per square inch, and each porjectile to weigh 180 pounds. and to be of good workmanship and of the standard service dimension. Their bid was accepted.

ELECTRICITY is now used as a motive power for unlocking a new burglar-proof safety device for bank safes.

A violent concussion on the outside of the door, by quick explosives, instantly locks this device whether the time lock opens or not, and the continuous application of an electric current sets in motion machinery inside which slowly but surely withdraws the bolt in the time previously set. A prominent time lock maker now uses a similar device in all his time locks, which not only gives double protection against accidents to the watch works, but security against a permanent lock-out by the use of high explosives.

THE Naval Advisory Board has recommended to the Secretary of the Navy that the navy be increased by twelve new cruisers, to be provided for in the appropriations for the fiscal year ending June 30, 1886. The Secretary recently directed the chiefs of the Bureaus of Construction and Repair, of Ordnance, of Steam Engineering and of Equipment and Recruiting, to submit estimates of the expenses to be incurred by their respective bureaus in completing these vessels. They have made their reports to the Secretary with estimates as follows: Construction, $4,161,000; engineering, $2,521,000; armament, $2,001,918, and equipment, $760,000; total estimated cost, $9,443,918.

THE following is an abstract of the bids for work on Long Lake Levee, Ark., opened Nov. 5th:

Jos. C. Neely, Bardwell, K. Y., Long Lake enlargement, 30c. per cubic yard; filling gap, etc., 24¾c. per cubic yard.

George Arnold, Memphis, Tenn., Long Lake enlargement, 26¾c. per cubic yard: filling gap, etc., 32¾c. per cubic yard.

Winters & Cooney, Memphis, Tenn., Long Lake enlargement, 25c. per cubic yard: filling gap, etc., 23c per cubic yard.

Contract awarded to Winters & Cooney.

THE following is an abstract of the proposals received for dredging in Norfolk Harbor, Va., and opened by Captain F. A. Hinman:

National Dredging Co., Wilmington, Del., 17¾c, per cubic yard.

H. E. Culpepper, Portsmouth, Va., 19¼c. per cubic yard.

Morris & Cummings Dredging Company, 45 Duane street, New York city, 20c. per cubic yard.

James Caler & Son, No. 1 Campbells wharf, Norfolk, Va., 18c. per cubic yard.

Atlantic Dredging Co., Brooklyn, N. Y., 19 7-10c. per cubic yard.

American Dredging Co., Philadelphia, Pa., 21c. per cubic yard.

George C. Fobes & Co., Raltimore, Md., 18¾c. per cubic yard.

New York Steam Dredging Co., 20c. per cubic yard.

P. Sanford Ross, Jersey City, N. J., 17¾c. per cubic yard.

The contract has been awarded to the National Dredging Co.

THE Highway Committee of Councils of Philadelphia has awarded to Joseph M. Paynter the contract for paving the Juniper and Clarion streets, from Tasker to Morris street, at $2.62 per square yard; Twenty-second street, from Christian to Spruce, at $2.49 per square yard, and Bancroft and Chadwick streets, from Dickinson to Tasker, at $2.59 per square yard,

M. C. Hong was given the contract for building a sewer 400 feet long between the Spring Garden pumping Station and Girard avenue bridge at $5.33 per yard, and 200 feet on Pennsylvania avenue, westward from thirty-third street at $2.17 per yard. A. Feldpauche was the only bidder for constructing the stone wall at the Junction Railroad, and he agreed to do tke work for $5,000. The Pennsylvania Railroad Company will contribute $15.000 for the work. Contracts were awarded to John Nolen for macadamizing Hancock street, from Penn to Miller street, at $1.13 per yard, and to John Kerrigan for macadamizing Walnut lane,from Green to Wayne street, at $1.19 per yard.

THE following is an abstract of the bids received by the Chief of Ordinance, U. S. Army, for converting fifty smooth-bore guns, by inserting a steel or a coil wrought-iron tube:

Midvale Steel Company—50 tubes, rough bored and turned, oil-tempered and annealed at 35c. per lb.; 50 rough forgings of breech cups, every fifth one tested, at 22c. per lb.; 50 muzzle collars, rough bored and turned, not tested, at 30c. per lb. Of the above collars those that are tested will cost 40c. per lb.

West Point Foundry Association—50 wrought-iron jacketed tubes, with muzzle collars, breech cups and plugs, $1,4 00each.

Jere Abbott & Co., of Boston, Mass., representing Thos. Firth & Sons of England:—50 annealed rough forgings for tubes, at 14c. per lb.; 50 rough bored tubes, all tempered and annealed, at 25 1-2c. per lb.; 50 rough finished forgings for muzzle-collars, untempered, at 15 1-2c. per lb. These prices are for the forgings delivered in New York or Boston in bond. The contract was awarded to the Midvale Steel Company.

SENOR ROMERO, the Mexican minister, has transmitted to the Secretary of State a decree issued by the State of Yucatan, Mex., offering a prize of $20,000 to the inventor of a machine which shall successfully extract the fibre from the henequin, under the following conditions:

It must be automatic, and not require skilled and experienced workmen to manage it. It must be entirely free ftom danger to the operators. It must require less motive force than the machines now in use with relation to its producing power. It must increase the production or extraction of the fibre within a given time, and diminish its loss, compared with the various machines in use.

The reward is to remain open for three years. At the expiration of that period, the government of Mexico will appoint a commission, who shall decide as to the merits of the machine, when the successful competitor will receive the sum named. The concession of this reward is without prejudice to the right of proprietorship and of patents that inventors may merit conformably to the laws.